Lake George Aquatic Vegetation Management Plan

Steuben County, Indiana Branch County, Michigan

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Executive Summary

The following report outlines a long-term aquatic plant management strategy for Lake George. Aquatic Weed Control was contracted by the Lake George Cottager's Association to conduct aquatic vegetation surveys and propose a vegetation management plan based on the results of these surveys. Funding for this plan was provided by the Lake George Cottager's Association and the Indiana Department of Natural Resources (IDNR) through the Lake and River Enhancement (LARE) program.

In 2006, Aquatic Weed Control conducted two aquatic vegetation surveys to characterize the plant community of Lake George. An early season qualitative survey (Tier I) was conducted on May 27, 2006, and a late season survey comprised of a Tier I and a Tier II quantitative survey was conducted on August 16, 2006. Each survey followed protocol established by the IDNR to evaluate the health of aquatic plant community. The Tier I survey is designed to give an overview of the plant structure in the lake, while the Tier II survey describes individual species distributions and abundances in more detail.

Based on the results of these surveys, as well as interaction with association members, lake users, and IDNR biologists, a management plan was constructed to help reach the three major management goals established by the IDNR for all Indiana public lakes, including those applying for LARE funding. These three goals are listed below.

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

The 2006 vegetation surveys of Lake George found a plant community with excellent species diversity (0.91). Seventeen plant species were collected in Lake George in the fall 2006 Tier II survey with 1 additional species (elodea) being collected in Mill Pond at the south end of the lake. Two invasive plant species, Eurasian watermilfoil (*Myriophyllum spicatum*), and curly leaf pondweed (*Potamogeton crispus*) were present in Lake George. Eurasian watermilfoil is of special concern in Lake George as it was collected throughout the entire lake in moderate to high abundance in spring of 2006. This plant species provides poor fish habitat, crowds out beneficial native plant species, and can impair recreation when present in great abundance.

Given Eurasian watermilfoil abundance in Lake George, funding may be awarded by the LARE program to chemically treat areas of infestation. Chemical treatment options for selective, root control of Eurasian watermilfoil include the following herbicides: Sonar (active ingredient: fluridone), Renovate (active ingredient: triclopyr), and 2, 4-D. Sonar treatments provide the most complete control of Eurasian watermilfoil and can also provide multiple years of control.

Renovate and 2, 4-D, while very effective, are normally applied to the same areas on a yearly basis to provide control.

Aquatic Weed Control recommends the use of Sonar to treat Eurasian watermilfoil in Lake George. Sonar will provide the most effective control and should be the most cost effective long term management strategy. However, based on meetings with IDNR fisheries and LARE biologists, as well as stringent requirements imposed by the state of Michigan, Lake George will not be considered a candidate for a whole lake Sonar treatment in 2007.

The 2007 treatment plan will use Renovate (active ingredient: triclopyr) to provide control of Eurasian watermilfoil along sections of shoreline in the Indiana waters of Lake George. Exact treatment areas will depend upon results of a spring 2007 vegetation survey, and up to 62 acres of Lake George may be treated to reduce the Eurasian watermilfoil population.

It is important to note that Eurasian watermilfoil will be the only plant species specifically targeted in this project, as LARE funds can only be awarded for the control of invasive plant species. The goal is not to eliminate vegetation in Lake George, but to improve the health of the plant community. Native vegetation will still be abundant in shallow areas after treatment, and control of these natives must be privately funded. The goal will be to reduce the Eurasian watermilfoil population and allow for the recovery of native plant species that will provide better fish habitat, foster good water quality and pose less interference to recreational use of the lake.

Cost estimates for 2007 are included below. These figures are estimates only and are subject to change pending 2007 chemical pricing. The current cost for 2007 surveying and planning is $4,000, although this cost may be reduced pending 2007 LARE surveying and planning requirements.

Project	Total Cost	LARE Share	Association Share
Treat up to 62 acres along Indiana's shoreline with Renovate for Eurasian watermilfoil	Up to $28,830	Up to $25,947	Up to $2,883
2007 Plant Surveys and Plan update	Up to $4,000	Up to $3,600	Up to $400
Totals	$32,830	$29,547	$3,283

Acknowledgements

Aquatic vegetation surveys conducted on Lake George were made possible by funding from the Lake George Cottager's Association and the Indiana Department of Natural Resources through the Lake and River Enhancement program (LARE). Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. IDNR fisheries biologists Neil Ledet and Larry Koza provided consultation regarding management strategies on Lake George. Gwen White and Angela Sturdevant, aquatic biologists for the LARE program provided valuable consultation regarding the requirements and objectives of this lake management plan. Brad Fink and Jason Doll also provided assistance and training for data analysis computer programs. Aquatic Weed Control would also like to thank the members of the Lake George Cottager's Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on September 9, 2006.

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1.0 Introduction

Aquatic Weed Control was contracted by the Lake George Cottager's Association to develop a long-term aquatic vegetation management plan. Funding for this report was provided by the Lake George Cottager's Association and the Department of Natural Resources through the Lake and River Enhancement (LARE) program.

When a person registers a boat within the state of Indiana a lake enhancement fee is included in the cost of registry. Two thirds of this money is then used to fund projects designed to improve the quality of Indiana lakes. One third of the total proceeds are designated for invasive plant control, while one third of the total proceeds are designated for construction projects and sediment removal.

The surveys included in this report, as well as the management plan, are required by the state to receive funding to treat the lake for exotic aquatic vegetation. Should a lake be selected for LARE funding, up to 100,000 dollars can be awarded for a whole lake treatment. Following a whole lake treatment up to 20,000 dollars per year can be awarded for up to 3 years for the maintenance of aquatic invasive plant species. If the whole lake is not treated, up to 20,000 dollars can be available annually for up to three years. Requests for funding are reviewed by the LARE office and funds will be distributed at the discretion of the director of the IDNR.

This project was initiated by the Lake George Cottager's Association to take a more aggressive approach to controlling Eurasian watermilfoil in Lake George. Eurasian watermilfoil is present throughout Lake George in moderate to high abundance. It becomes abundant in late spring and increases as the summer progresses. The proposed management strategy in this report is aimed at providing effective control for Eurasian watermilfoil, protecting native plants, minimizing environmental risks, improving fish habitat, and enhancing recreational opportunities at Lake George.

The following list is adapted from the IDNR LARE Manual and includes both common and scientific names of many aquatic plants found in Indiana. It also includes species codes that may appear in data sheets or other figures. This list may be a useful reference for plants mentioned in this report, or in other publications.

Appendix C. Species Codes

Species Code	Scientific Name	Common Name	Vegetation Type
ALGA	Any species of filamentous alga (incl. Spyrogyra, Cladophora, Hydrodictyon)	algae	NV
AZ?OL	*Azolla* sp.	A mosquito fern sp.	NV
AZCA	*Azolla caroliana*	Carolina mosquito fern	NV
AZME	*Azolla mexicana*	Mexican mosquito fern	NV
CEDE4	*Ceratophyllum demersum*	coontail	SB
CH?AR	*Chara* sp.	A chara sp.	SB
ELCA7	*Elodea canadensis*	Canadian waterweed	SB
ELNU2	*Elodea nuttalli*	western waterweed	SB
LEMN	Species within the Lemnaceae	duckweeds	NV
LEMI3	*Lemna minor*	small or common duckweed	NV
LETR	*Lemna trisulca*	star duckweed	NV
LUDE4	*Ludwigia decurrens*	primrose-willow	FL
LVWORT	*Riccia* sp., *Ricciocarpus* sp.	A liverwort species	NV
MYSI	*Myriophyllum sibiricum*	northern watermilfoil	SB
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil (exotic)	SB
MY?RI	*Myriophyllum*, unidentified species	a watermilfoil sp.	SB
NAFL	*Najas flexilis*	slender naiad (exotic)	SB
NAGR	*Najas gracillima*	slender waternymph	SB
NAGU	*Najas guadalupensis*	southern waternymph	SB
NAMI	*Najas minor*	brittle waternymph	SB
NLPW	*Potamogeton foliosus*, *P. pusillus*, or other unidentified narrow-leaved pondweeds	narrow-leaved pondweeds	SB
NELU	*Nelumbo lutea*	American lotus	FL
NI?TE	*Nitella* sp.	A nitella sp.	SB
NOAQVG		no aquatic vegetation at site	NV
NULU	*Nuphar variegetum* (formerly N. luteum)	yellow pond lily	FL

NYTU	*Nymphaea tuberosa*	white water lily	FL
POAL8	*Potamogeton alpinus*	red or alpine pondweed	SB
POCR3	*Potamogeton crispus*	curly-leaf pondweed (exotic)	SB
POEP2	*Potamogeton epihydrus*	ribbon-leaf pondweed	SB
POFO3	*Potamogeton foliosus*	leafy pondweed	SB
POGR8	*Potamogeton gramineus*	variable pondweed	SB
POIL	*Potamogeton illinoensis*	Illinois pondweed	SB
PONO2	*Potamogeton nodosus* (formerly *P. americanus*)	American pondweed	SB
POPE6	*Potamogeton pectinatus*	sago pondweed	SB
POPR5	*Potamogeton praelongus*	white-stemmed pondweed	SB
POPU7	*Potamogeton pusillus*	small pondweed	SB
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	SB
POZO	*Potamogeton zosteriformis*	flat-stemmed pondweed	SB
RAFL	*Ranunculus flabellaris*	yellow water-cup (yellow water buttercup)	SB
RALO2	*Ranunculus longirostris* (incl. *R. trichophylus*)	white water-cup (rigid white water buttercup)	SB
SPPO	*Spirodela polyrhiza*	greater duckweed	NV
UNKN01		Unknown specimen No. 1	
UNKN02		Unknown specimen No. 2	
UTMA	*Utricularia vulgaris* (also known as *U. macrorhiza*)	common bladderwort	SB
VAAM3	*Vallisneria americana*	wild celery	SB
WO?LF	*Wolffia*, unidentified sp.	A watermeal sp.	NV
WOCO	*Wolffia columbiana*	watermeal	NV
ZAPA	*Zannichellia palustris*	horned pondweed	SB
ZODU	*Zosterella dubia* (also known as *Heteranthera dubia*)	water stargrass	SB

2.0 Watershed and Lake Characteristics

Lake George is located north of Angola, Indiana, just west of old U.S 27. Its lies on the Indiana/Michigan border, with waters in both Steuben County, Indiana and Branch County, Michigan. It has 509 surface acres with a maximum depth of 71 feet and an average depth of 22 feet (Tylia, 2000).

The only major inlet to Lake George is an unnamed stream that runs south from Silver Lake in Branch County Michigan and enters Lake George from the north. The only outlet to Lake George is Crooked Creek, which flows out of Mill Pond through Mud Lake and into Snow Lake and the rest of the Lake James Chain (Koza, 2001).

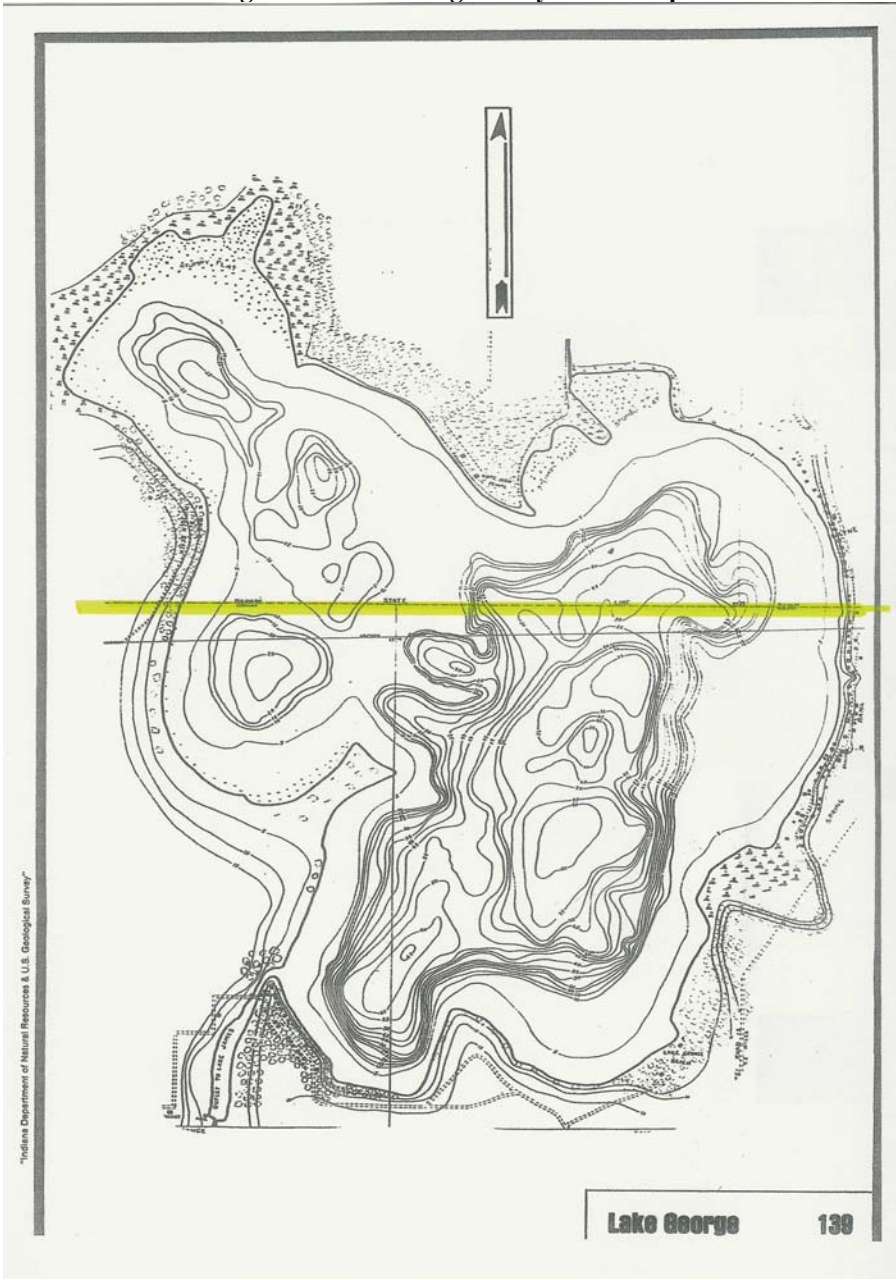
Lake George has very good water quality and water clarity when compared to many other northern Indiana lakes. Secchi disk readings (a measure of water clarity) are usually measured at approximately 10 to 11 feet (Tylia, 2000). A lake wide sewer system has also

been implemented, which helps to keep excess nutrients from entering the lake and reducing water quality.

Major land use in the Lake George watershed is for residential and agricultural purposes, and Lake George's lack of inlet streams undoubtedly helps to maintain good water quality.

Figure 1 is a bathymetric map of Lake George from Uncle Larry's Lake Maps. Lake George has a complex morphological structure with many large areas of shallow water, deep holes underwater points, sandbars, and mud flats. This complex morphology fosters the growth of many types of vegetation, both native and invasive. Areas with mud and muck sediments tend to be more vulnerable to invasive species, than do hard bottom areas of sand or gravel. In Lake George two areas with mud sediments are the area adjacent to the public access site and the northeast corner of the lake from Kope Kon Point north to the inlet.

Figure 1: Lake George Bathymetric Map



3.0 Lake Uses

Lake George is valuable to both lake residents and the general public as well. A public access site was constructed by the Michigan Department of Natural Resources and is located at the northwest corner of the lake. This site provides the public with access to the lake, meaning that any management practices implemented on the lake will benefit a large number of Indiana residents.

Popular activities on the lake include boating, skiing, and fishing. Good water quality makes Lake George an attractive lake for water skiing, wave running and swimming. A diverse fishery also makes it a popular lake for fishermen. Largemouth bass, and northern pike are popular sport fish along with panfish. More information about the Lake George fishery is included in section 4.0 in this report. Summer weekends can be very crowded on the lake, because of the large number of homes on the lake and the public access site.

4.0 Fisheries

The IDNR has conducted fisheries surveys on Lake George in 1968, 1979, and 2001. The MDNR has surveyed the lake in 1968 and 1986. The most recent fisheries survey conducted on Lake George took place from June 18-21, 2001. Twenty fish species were collected during this survey, with bluegill being the dominant species by number and northern pike being the dominant species by weight. Good numbers of many sport fish were found during this survey, and no additional management was recommended by fisheries biologists.

The Michigan DNR stocked 15,000 walleye fingerlings in 1986, but the walleyes failed to establish a quality fishery. Very few of these fish were reported to be caught. The Lake George Cottager's Association has also stocked walleye in the past three years. They have stocked larger walleye (6-8 in.) in hopes to reduce predation from other fish and increase survival rates. Approximately 1,300 to 4,000 walleye have been stocked annually.

One major change over time in the Lake George fishery is the percentage of harvestable bluegills available. In 1979, 23.0% of bluegills collected were of harvestable length (6 in.). In the most recent survey, this percentage dropped to just 7.7%.

In summer of 2002 Lake George lost many largemouth bass to Largemouth Bass Virus (LMBV). Most of these fish were mature bass. Many times, bass are carriers of the virus and seldom die, although large die-offs are possible, especially when fish are stressed. 2001 survey results suggest that the bass population at Lake George remains stable and the virus is not expected to have a long term impact on the bass population in Lake George.

Table 1 is species list representing all fish collected in the 2001 DNR fisheries survey.

Table 1: IDNR Fisheries Species List (Koza, 2001)

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	607	48.9	1.2-7.7	38.08	6.9
Redear	283	22.8	2.0-11.3	89.82	16.2
Largemouth bass	66	5.3	4.3-18.4	63.40	11.5
Yellow perch	59	4.8	3.2-11.9	6.91	1.2
Northern pike	47	3.8	17.4-32.1	146.50	26.5
Rock bass	33	2.7	2.1-11.7	13.32	2.4
Warmouth	29	2.3	2.8-7.9	5.31	1.0
Longnose gar	28	2.3	23.6-49.7	123.22	22.3
Black crappie	26	2.1	3.2-13.5	6.60	1.2
Yellow bullhead	22	1.8	9.2-15.2	20.16	3.6
Pumpkinseed	13	1.0	4.3-6.1	1.80	0.3
Hybrid sunfish	7	0.6	6.0-7.5	1.66	0.3
Brown bullhead	5	0.4	11.9-14.5	6.97	1.3
Smallmouth bass	4	0.3	7.3-18.8	3.94	0.7
Spotted gar	4	0.3	20.9-27.9	9.29	1.7
Bowfin	3	0.2	23.5-25.7	15.61	2.8
Golden shiner	3	0.2	3.5-7.0	0.28	0.1
Bluntnose minnow	1	0.1	2.5	0.01	0.0
Lake chubsucker	1	0.1	3.7	0.03	0.0
Brook silverside	present				0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
		0.0			0.0
Total (20 Species)	1241	100.0		552.91	100.0

*Common names of fishes recognized by the American Fisheries Society.

Table 2 shows ages and lengths for bluegills, redear and largemouth bass in Lake George.

Table 2: IDNR Fisheries Ages and Lengths (Koza, 2001)

Lake George 2001

Species Bluegill	Year Class	Number Aged	Back Calculated Length(inches)at Each Age							
			I	II	III	IV	V	VI	VII	VIII
Intercept = 0.8	2000	4	2.1							
	1999	9	2.0	2.5						
	1998	12	1.8	2.7	3.6					
	1997	15	1.6	2.9	4.1	5.2				
	1996	4	1.8	2.5	3.7	4.7	6.0			
Average Length			1.9	2.7	3.8	5.0	6.0			
Standard Deviation			0.18	0.18	0.26	0.34				
Yr. Classes Averaged			5	4	3	2	1			

Species Redear	Year Class	Number Aged	Back Calculated Length(inches)at Each Age							
			I	II	III	IV	V	VI	VII	VIII
Intercept = 0.6	2000	3	2.2							
	1999	27	1.8	3.8						
	1998	10	1.6	3.2	4.8					
	1997	17	2.2	3.8	6.2	7.5				
	1996	12	2.0	4.0	6.9	8.9	10.0			
	1995	2	1.9	4.3	7.0	8.6	9.7	10.5		
	1994	1	2.0	3.6	6.8	8.2	9.2	9.9	10.4	
Average Length			2.0	3.7	6.0	8.2	10.0			
Standard Deviation			0.25	0.33	1.04	1.00				
Yr. Classes Averaged			5	4	3	2	1			

Species Largemouth bass	Year Class	Number Aged	Back Calculated Length(inches)at Each Age							
			I	II	III	IV	V	VI	VII	VIII
Intercept = 0.8	2000	4	3.8							
	1999	8	2.7	5.9						
	1998	19	2.9	6.2	9.4					
	1997	13	2.5	5.3	8.4	11.1				
	1996	11	2.7	5.4	8.2	10.9	13.4			
	1995	2	3.2	6.4	9.8	12.9	14.8	16.2		
	1994	2	2.5	4.8	7.5	10.0	13.2	15.4	17.2	
Average Length			2.9	5.7	8.6	11.0	13.4			
Standard Deviation			0.52	0.42	0.63	0.18				
Yr. Classes Averaged			5	4	3	2	1			

NOTE: Age groups with less than three samples are not included in year class averages or standard deviation.

5.0 Problem Statement

Eurasian watermilfoil is the major invasive threat to the Lake George plant community. In lakes where Eurasian milfoil is left unchecked, well-diversified plant communities can be decimated, although in some lakes native plants compete well with Eurasian watermilfoil. Eurasian milfoil has the ability to "overwinter," giving it a distinct growth advantage over many native plants. The milfoil lies dormant during the winter months instead of dying back completely, as do many natives. As spring arrives, the dormant milfoil plants have a head start on many native plants and reach the surface faster, shading out the natives. Eurasian milfoil grows profusely, provides poor fish habitat, inhibits boat navigation, and causes annoyances and even serious recreational hazards to skiers, swimmers, and other members of the public wishing to enjoy the lake.

Lake George's has a relatively large littoral zone (~300 acres) when compared to its total surface acreage (509 acres). The large amount of shallow water areas (~59% of the lake) in Lake George give Eurasian watermilfoil a large area of suitable habitat on which to grow. Lake George does have the advantage of a diverse native plant community which should help slow the spread of the invader. This also increases the chances that other beneficial plants will take the place of Eurasian watermilfoil if it is selectively treated. Since a whole lake Sonar treatment will not be feasible in 2007, the near shore areas should be the focus of management activities to improve recreation and reduce the Eurasian watermilfoil population. By selectively treating for Eurasian watermilfoil on a yearly basis, native plants may replace the milfoil in areas that were once heavily infested. It is possible that with time and planning, a whole lake sonar treatment may be possible in the future. Any whole lake Sonar treatment will require written permission from 100% of Lake George property owners on the Michigan side of the lake, or the establishment of a special assessment district. Procedures must be in accordance with The Natural Resources and Environmental Protection Act 451 of 1994, Part 309 (Inland Lake Improvements). More information regarding these requirements is included in the appendices to this report.

Michigan law will currently allow Sonar concentrations to be calculated using an average depth of no more than 10 feet. Since Lake George has an average depth of 22 feet, a lawful application would likely fall short of the target concentration of 6ppb which could result in treatment failure.

6.0 Vegetation Management goals and Objectives

The following management goals have been established by the IDNR for all Indiana lakes, including those applying for LARE funding. Any management practices implemented on Lake George are to directly facilitate the achievement of these three goals:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Specific Objectives:

Specific objectives are needed to ensure that the fundamental goals of the LARE program are met. The following steps are recommended to help achieve LARE management goals for Lake George.

1. **Areas infested with Eurasian watermilfoil in Indiana waters will be treated with Renovate herbicide.** Exact treatment areas will depend upon results of a spring 2007 survey. Using Renovate will provide selective root control of Eurasian watermilfoil.

2. **The Mill Pond should also be treated for Eurasian watermilfoil with Renovate.** This area was treated in 2006, and the treatment should continue to reduce the milfoil population.

3. **Vegetation surveys should be conducted to evaluate the plant community both before and after treatment in 2007.** A Tier II vegetation survey should be conducted after the chemical treatment to evaluate the plant community.

7.0 Past Management Efforts

The Mill Pond (8 acres) was treated with Renovate (active ingredient triclopyr) on September 9, 2006 with LARE funding as it was heavily infested with Eurasian watermilfoil. Herbicide treatments using contact herbicides on private frontages and channels are common in Lake George. Permitting for the past five years includes a large treatment area in the northeast bay of the lake(~4 acres) as well as the area north of the public access site(~1acre). A large stretch of shoreline (~1600 feet) along Brown's Point, as well as other individual properties. These treatments were done upon request by private property owners. Before Lake George's involvement in the LARE program no lake wide vegetation management strategy had been fully developed, and chemical treatments were limited to contact herbicides applied along lake frontages at the request of property owners. The vegetation management strategy in this plan should provide better control of Eurasian watermilfoil on a larger scale and improve recreational access to Lake George.

8.0 Aquatic Plant Community Characterization

All lake management plans submitted for LARE funding must be accompanied by lake-wide aquatic vegetation surveys. These surveys are used to ensure that the plant community of the entire lake is adequately characterized. They provide information about the overall structure of the plant community, and describe species distribution and abundance in detail.

Two surveys are conducted on each lake in the first year it is involved in the LARE program. One survey is conducted in the spring and another is conducted later in the summer. This two-survey process is essential in providing an accurate representation of all plant species in a lake. Some species such as eel grass (*Vallisneria americana*) are not prevalent until summer and may be under-represented if only one survey was conducted in the spring. Other species such as curly-leaf pondweed (*Potamogeton crispus*) are prevalent in the spring and

die off in the summer. This species would be under-represented if only one survey was conducted in the summer. Because of the diverse life cycles of different plants, multiple surveys increase the chance of accurately representing all of the species in a lake

Tier I and Tier II survey protocols have been established by the IDNR to ensure that each lake is surveyed in the same manner. These surveys reduce subjectivity and provide a consistent basis for the evaluation of a lake's plant community from year to year, as well as a basis for comparing the plant communities of different lakes. They provide quantifiable results that are vital for monitoring the success of management programs. In short, these vegetation surveys are the foundation for describing an aquatic plant community and proposing an effective management strategy.

8.1 Methods

This section provides an overview of the purpose and procedures behind the Tier I and Tier II vegetation surveys. The common goal of these surveys is to accurately describe the aquatic plant community of any particular lake. Standard procedures are established to ensure that:

1. The same survey procedures are used for each lake applying for funding.

2. Objectivity is kept to a minimum to maintain scientific integrity.

3. The sample size for each survey adequately describes the plant community.

4. All data from each lake is recorded and analyzed in the same format.

In short, procedural and analytical consistency makes data from different surveys suitable for comparison and evaluation, while increasing its reliability and overall utility for evaluating the health of a plant community.

The Tier I survey involves finding and identifying the major plant beds in the lake. In lakes with high water clarity, this can be accomplished visually. In lakes with low water clarity, a rake may be lowered into the water to collect plants and identify areas of abundant plant growth. The composition of each major plant bed is then recorded.

The Tier II survey involves using a specially designed rake to collect plants from numerous sites throughout the entire lake. At each site, each species found is recorded, and given an abundance rating based on the amount collected.

These protocols are currently being used by IDNR fisheries biologists to describe the plant communities of Indiana lakes. They are accepted as practical ways describe a plant community in detail and provide quantifiable evidence as to the overall health of an ecosystem. For these reasons, the following surveys are being used to describe plant communities in all lakes applying for LARE funding.

8.1.1 Tier I

The Tier I reconnaissance survey is designed to identify the major plant beds present in a body of water. This is a qualitative survey designed to give an overview of the aquatic vegetation present in a lake. It identifies and documents problem areas that can be targeted when management practices are implemented. Major submersed plant beds are found visually from a boat. Each bed is given a reference number that is recorded on Tier I data sheets. The general location of these beds are recorded on a bathymetric map of the lake, and more precise locations are recorded on Tier I data sheets with the help of a WAAS enabled GPS unit.

When a major plant bed is identified, each species of plant found in that bed is recorded. Canopy ratings are given to each plant bed based on the types of plants present in that bed. The four major types of plants to be identified in this study are as follows: submersed plants, emergent plants, non-rooted floating plants and rooted floating plants. The following scale is used to describe these four types of plants based on the percentage of the plant bed canopy they occupy:

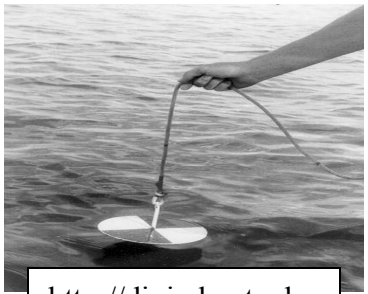
Canopy Rating

1 = < 2% of canopy
2 = 2-20%
3 = 21-60%
4 = >60% of canopy

In addition to the canopy rating, another abundance rating is given to each individual species found in a particular plant bed. This abundance rating is based on the percentage of the entire bed area that species appears to occupy. The scale for this abundance rating is the same as the canopy rating scale. The difference is that this scale identifies the abundance of *individual species* in the bed:

Species Abundance Rating

1 = < 2% of the bed
2 = 2-20%
3 = 21-60%
4 = >60% of the bed



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Secchi disk readings are taken prior to the vegetation surveys. Secchi are plate-like objects used to measure water clarity. The disk is lowered into the water until it disappears. Once it has disappeared, it is then raised slightly until it is just barely visible. At this point, marked points on the secchi rope are used to determine the maximum depth at which the disk can be seen. In lakes with clear water, the Tier I survey is primarily a visual survey, in lakes with low water clarity, rake throws and the use of electronics help to locate and describe plant beds. The Tier I survey is a valuable tool that helps to provide an overall picture of an aquatic plant community when coupled with the Tier II quantitative survey.

8.1.2 Tier II

The purpose of Tier II surveys is to document the distribution and abundance of submersed and floating-leaved aquatic vegetation throughout a lake (IDNR, 2004). A specific number of sample sites are selected based on the amount of surface acreage the lake possessed. Once sample sites are determined, sampling is accomplished using an aquatic vegetation sampling rake constructed according to the guidelines of the 2006 Tier II random sampling procedure manual.

Aquatic vegetation collected at each sample site is sorted according to species, and given a value to represent its abundance at that site. These values are recorded on data sheets distributed by the IDNR. These records are used for data analysis that served to characterize the aquatic vegetation community of Lake George.

Random Sampling:

The Tier II survey protocol was changed by the IDNR in 2006. New LARE Tier II protocol requires that sample sites be stratified by depth contour. Prior to 2006 sites were to be spaced evenly through the littoral zone.

Before 2006, the number of sample sites required each lake were determined strictly by lake size. In the 2006 protocol, the number of sample sites needed is based on both lake size and trophic state. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic Lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 3 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 3: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 4 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 4: Sample Sites by Lake Size and Trophic Depth

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

Based on Lake George's 509 surface acres and its classification as oligotrophic, 80 sample sites were needed to describe this plant community. Aerial photographs and bathymetric maps were used to evenly space the sample sites throughout the lake. The littoral zone of the lake was divided into four quadrants of equal length. During the vegetation collection process, an effort was made to collect plants from an equal number of sites in each quadrant to ensure that the entire littoral zone was surveyed adequately and that random sample sites distributed evenly throughout the lake.

Aquatic Vegetation Sampling Rake:

A double-headed garden rake was used to sample aquatic vegetation. This rake design is approved and used by IDNR fisheries biologists in vegetation surveys on many Indiana lakes. It consists of two garden rake heads welded together back to back so that rake teeth are protruding from two sides. The dimensions of the rake are to be 13.5 inches wide with 2.25-inch long teeth spaced 0.75 inches apart (IDNR, 2004).

Each tooth on the rake head is divided into five equal sections and marked accordingly. These marks on the rake teeth are used to estimate the abundance of plant species when they are collected.

A nylon rope is then attached to the rake head. A black permanent marker is used to mark the rope in foot long increments. A red mark is placed every five feet along the rope. This rope is used to measure the depth at each sample site when the rake is lowered to the lake bottom.

GPS and Mapping:

A WAAS enabled GPS unit was used to obtain and record the coordinates of each sample site on the lake. A WAAS enabled GPS unit is accurate to within 3 meters and was recommended to obtain maximum accuracy for mapping sample sites. All GPS coordinates were then used to produce computer generated maps of the lake with each sample site labeled on the map.

Sampling Procedure

A two-person crew accomplished Tier II aquatic vegetation sampling by boat. A crew leader was responsible for driving the boat to each sample site and recording vegetation data on record sheets issued by the IDNR. An assistant was responsible for collecting the aquatic plants using the double-headed rake.

When a sample site was reached, its GPS coordinates were obtained and recorded. The boat was then brought to a complete stop and the double-headed rake was lowered to the bottom of the lake. The boat was held stationary while the water depth at the sample site was obtained by using the marked rope attached to the rake. When water depth had been recorded, the crew leader slowly backed the boat away from the rake as the assistant simultaneously let out another ten feet of rope. During this process the rake did not move from the lake bottom.

The rake was pulled from the water after the boat had reached the end of the ten extra feet of rope let out after the depth was recorded. This ensured that the rake was pulled horizontally through the water, giving it a greater chance of collecting weeds than if the rake had been lowered to the bottom and raised vertically. The vegetation caught on the teeth of the rake was then gathered into the boat.

Determining Vegetation Abundance

At each sample site, every plant species collected on the rake was scored according to its abundance. This was accomplished by removing all plants from the rake and sorting them by species. Once all plants had been sorted, they were placed back onto the rake and evenly distributed across the marks on the rake teeth. If a species filled the rake to the first mark on the teeth, that species was given a score of 1 on the abundance data sheet. If it filled the rake teeth to the second mark, it was given a score of 2, and so on to a maximum abundance of five. In many instances it was not necessary to place each species back onto the rake. Many species would fill the rake completely (an abundance of 5) and some species would only have one plant on the rake (an abundance of 1). In addition to abundance scores for individual species, each rake toss was given an overall abundance score, describing how much total vegetation was collected on the rake.

8.1.3 Analytical Methods

One of the methods used to analyze the Tier II data was an IDNR Vegetation Database. Survey data was imported from Microsoft Excel and used to calculate plant community metrics that describe the plant community of a lake. This program and these metrics are used

by biologists throughout the state and provide consistency in data analysis procedures. This consistency makes Tier II data more useful for comparisons between lakes and from year to year.

Delorme X-Map 4.5 was used to map major plant beds and individual species distributions. To map individual species, GPS coordinates representing each sample site where the species was collected were imported into the program and displayed on a computer generated map of the lake. For major submersed plant beds and emergent plant beds, a bathymetric map of the lake was imported into the program and geo-referenced to ensure greater accuracy for the locations of plant beds. A combination of GPS coordinates, landmarks, field notes, and the bathymetric map helped to estimate the exact locations of each plant bed. Estimates of plant bed sizes were calculated using X-Map after each bed was drawn on the bathymetric map.

8.2 Results

8.2.1 Tier I Results

Tier I plant surveys were conducted on May 27th and August 16th of 2006. The submersed plant community of Lake George covers roughly 302 acres of the lake, or 59% of the lake's total surface area. Dominant plants in the spring survey were chara, Eurasian watermilfoil, whorled watermilfoil, and sago pondweed. Plant growth is common to depths of 18 feet, due to good water clarity. Both Eurasian watermilfoil and native whorled watermilfoil are present in shallow water around dock and piers. During the 2006 Tier I survey, 7 major plant beds were identified. The composition of these plant beds was fairly stable from spring to fall.

Problem Plant Areas:

Eurasian watermilfoil was found in 5 of the 7 plants beds during the spring 2006 Tier I survey. Heaviest areas of infestation were in plant beds #4, and #7, along with the Mill Pond. Plant bed #5 also had pockets of Eurasian watermilfoil mixed with large amounts of curly leaf pondweed. Curly leaf pondweed was very dense in only 6 acres of the lake. In the majority of the lake, Eurasian watermilfoil is extremely common though it is often not the dominant species. Its patchy distribution throughout the entire lake makes effective spot treatments difficult, which is why Sonar was originally recommended.

Beneficial Plant Areas:

Plant bed # 2 is the largest plant bed in Lake George and also one of the most diverse. It is a deep water plant bed, offering lots of vertical structure that is beneficial to fish populations. It also causes little interference with recreation, as the plants in this bed seldom reach the surface of the water.

The wetland area to the north of the MDNR public access sites is another beneficial plant area. It is the only undeveloped area on the lake, and contains many beneficial wetland species. The benefits of wetland areas are well documented, and include water filtration, shoreline stabilization, and wildlife habitat. Preserving this area will help protect water quality and Lake George.

Figure 2 shows the locations and acreages for the major plant beds in Lake George.

Figure 2: Lake George 2006 Major Plant Beds

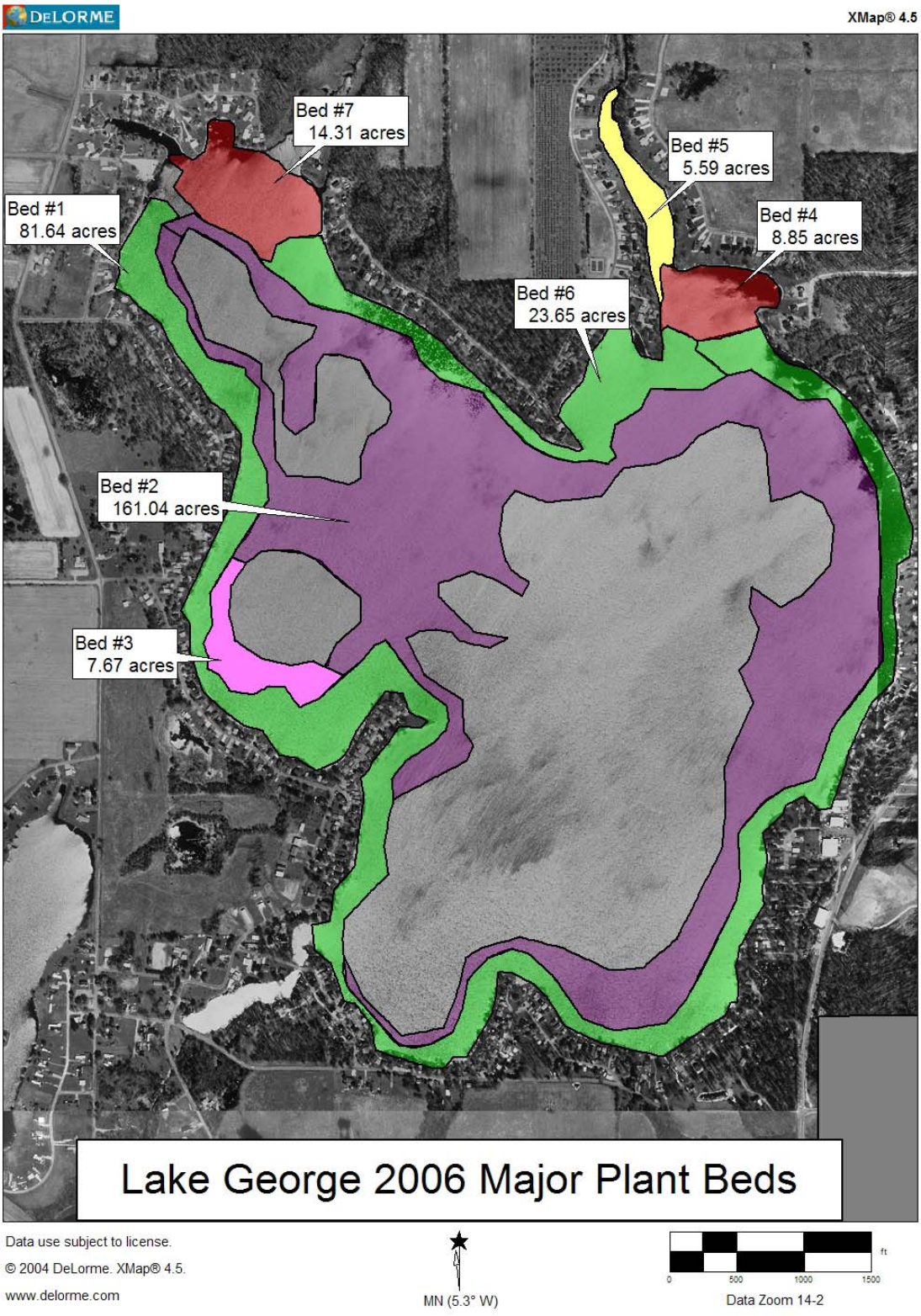


Table 5 shows all of the plant species found in the Tier I survey and there abundance rating for each plant bed. Blanks indicated that the plant was not present in a particular bed.

Table 5: 2006 Tier I Plant Beds

Lake George 2006 Tier I Submersed Plants

Species Abundance by Plant Bed #

	#1	#2	#3	#4	#5	#6	#7
Plant Species							
American Elodea				1			1
Bladderwort		2					
Chara	3		3	1		3	2
Coontail							
Curly-Leaf Pondweed				1	4		1
Duckweed					1		
Eurasian Milfoil	1	2		3	2		3
Flat-stemmed Pondweed		1		1			1
Illinois Pondweed	1						
Leafy Pondweed		1					1
Largeleaf Pondweeed	1	1		1		1	1
Northern Watermifoil		2		2			1
Richardson's Pondweed	1	1	1			1	1
Sago Pondweed	2	2		1	1	1	1
Whorled Watermilfoil	2	2		3		2	3
Total # of Species	**7**	**9**	**2**	**9**	**4**	**5**	**11**
Size (Acres)	*81*	*161*	*7*	*9*	*5*	*23*	*14*

Plant Bed #1
Size: 81 acres
Substrate: Sand/Silt
Number of Species: 7
Description: This very large plant bed rings much of the shoreline of Lake George. The plant community found here in 0-5 feet of water is fairly diverse, and is dominated by chara. Whorled watermilfoil and sago pondweed were also found in moderate abundance (2-20%). Richardson's pondweed, largeleaf pondweed, Illinois pondweed, and eelgrass were all scattered throughout the bed in lower abundance. Although Eurasian milfoil was not overly abundant in this bed during the spring survey, its abundance appeared to increase as the year went on. It seemed to favor sediment that was silted, and was dense in small areas though seldom dominant.

Plant Bed #2
Size: 161 acres
Substrate: Silt/Sand
Number of Species: 9
Description: Plant bed #2 was the largest bed found in the lake at 161 acres. Although it was very large, it showed consistency in both structure and composition throughout. This bed ringed the lake in approximately 7-16 feet of water, and its sediment appeared to have higher organic content than plant bed #1. It also had significantly more vertical structure than plant bed #1. "Tall growing" plants like coontail, Eurasian watermilfoil, northern watermilfoil, sago pondweed and bladderwort were all common throughout the plant bed. No plant showed extreme dominance, which is common in highly diverse areas. There were, however, small sections of extremely dense Eurasian watermilfoil, as well as some dense stands of the native whorled watermilfoil. Flat-stemmed pondweed, leafy pondweed, Richardson's pondweed and largeleaf pondweed were also present in lower abundance.

Plant Bed #3
Size: 7 acres
Substrate: Sand/Silt
Number of Species: 2
Description: This smaller plant bed is located in approximately 7 feet of water but differed from plant bed # 2 in species richness. It was much less diverse than bed #2 in the spring survey, with rake throws revealing only 2 species: chara and Richardson's pondweed. This difference seemed to diminish in the fall as other species were found in this area during the Tier II survey. A sandy bottom content may have accounted for the delayed growth of many species in this area during the spring.

Plant Bed #4
Size: 9 acres
Substrate: Silt/Sand
Number of Species: 9
Description: Plant Bed #4 is composed of the small bay at the northeast corner of the lake. Bed #4 was fairly diverse for its size, as it contained nine plant species. Whorled watermilfoil and Eurasian watermilfoil were dominant and present in roughly the same abundance. Northern milfoil was also found in slightly less abundance. Although this plant bed was not a monoculture of Eurasian milfoil, its abundance in bed #4 was higher than in many other areas of the lake. Highly organic sediment, along with boat traffic traveling to and from the channel in this bay makes it a likely feeder area fro Eurasian milfoil to the rest of the lake.

Plant Bed #5
Size: 5.5
Substrate: Silt/Sand
Number of Species: 4
Description: Plant bed #5 is another area of concern for Lake George. It has lower diversity than most areas on the main lake, and the two most dominant species in this plant bed are both invasive species. In the spring survey, curly leaf pondweed was by far the most dominant plant in this bed, covering over 60 % of the surface area and Eurasian watermilfoil was the second most dominant plant in this bed. There was a small amount of native northern milfoil as well in this plant bed. Duckweed was also present, indication high

nutrient availability in this area of the lake. This is another primary area of concern for the proliferation of invasive plant species in Lake George.

Plant Bed #6
Size: 23.6 acres
Substrate: Sand/Silt
Number of Species: 5
Description: Plant bed #6 is located in 0-5 feet of water along the northern shoreline of the lake. It is very similar to plant bed #1 with slightly less diversity. Chara is the most dominant plant is this area, accounting for about 60% of the plant bed. Whorled watermilfoil is fairly abundant in this area as well and grows in small but very dense stands. Largeleaf pondweed, Richardson's pondweed and sago pondweed are also present in this bed in lower abundance.

Plant Bed #7
Size: 14 acres
Substrate: Sand/Gravel
Number of Species: 11
Description: Plant bed #7 was the most diverse area in the lake containing 11 different species. It is located near the public access site in the northwest corner of the lake. It is adjacent to the largest wetland area on Lake George, along one of the few undeveloped stretches of shoreline. Whorled watermilfoil and Eurasian watermilfoil are prevalent and occur in roughly the same abundance. There were stands of Eurasian watermilfoil becoming very dense and reaching the surface of the water by August of 2006. Curly leaf pondweed, another invasive plant was found in low abundance as well. Eight other native plant species were scattered throughout this plant bed in low to moderate abundance.

Emergent Plant Beds

Major beds of emergent vegetation are rare on Lake George, as the shoreline is nearly 100% developed. All of the emergent beds found in this survey are in Michigan waters. Figure 3 shows these wetland areas outlined in green.

Figure 3: Lake George Emergent Plant Beds

Table 6 describes the plant composition of the major wetland areas of Lake George. Plant bed numbers in this table correspond to the numbers in Figure 3.

Table 6: 2006 Emergent Plant Beds

Lake George 2006 Tier I Emergent Plants

Species Abundance by Plant Bed #

	#1	#2	#3
Plant Species			
White water lily	2	2	2
Spatterdock	3	3	2
Pickerel weed	2	1	1
Cattail		3	2
Softstem bulrush		1	1
Total # of Species	**3**	**5**	**5**
Size (Acres)	*0.5*	*9.6*	*0.25*

Emergent Bed #1
Size: 0.5 acre
Substrate: Silt/Sand
Number of Species: 3
Description: This half acre plant bed is adjacent to the MDNR public access site. It is a relatively small emergent plant bed and contains 3 species. Spatterdock is dominant, and white lilies and pickerel weed are present as well.

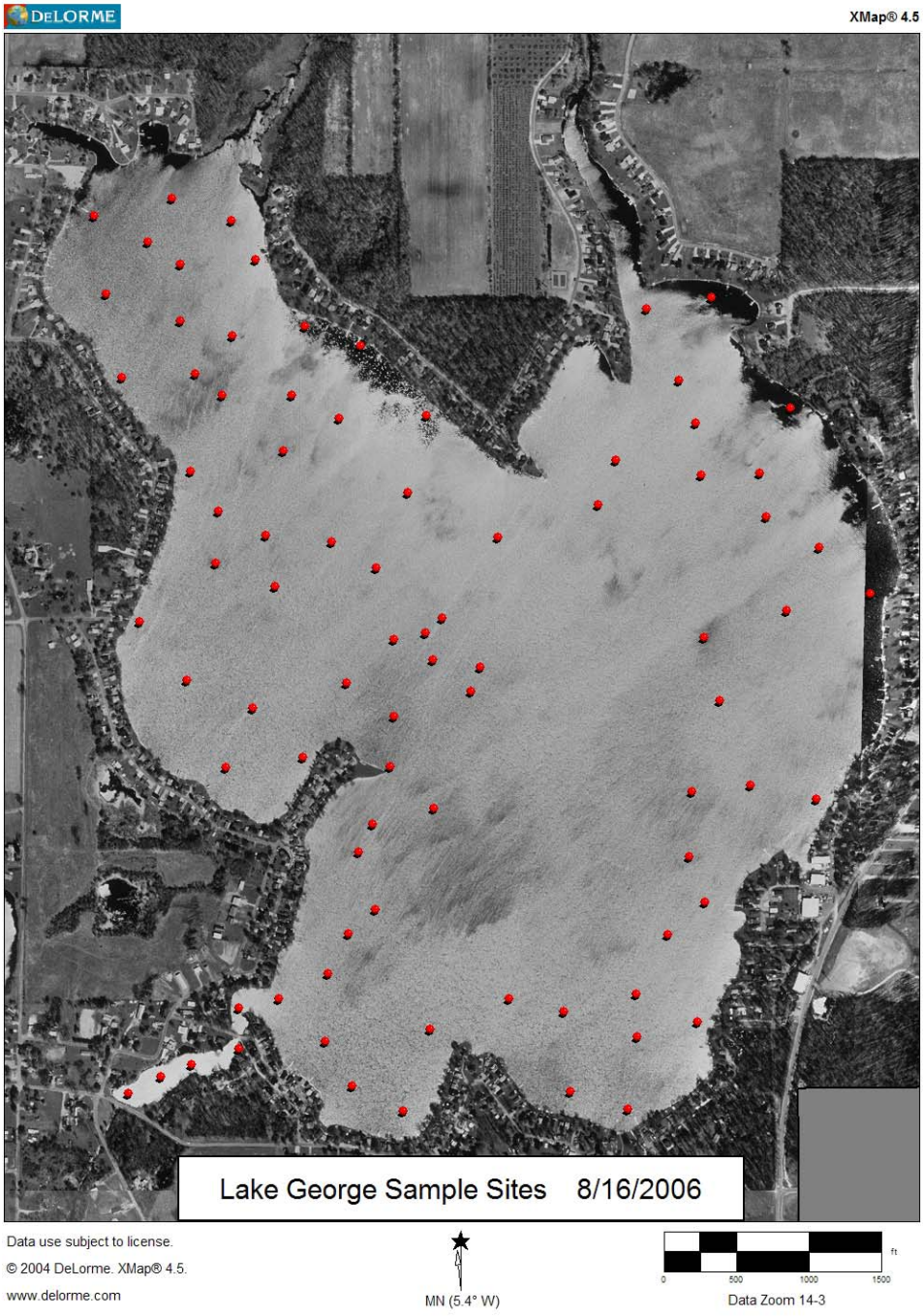
Emergent Bed #2
Size: 9.6
Substrate: Silt/Sand
Number of Species: 5
Description: This is the largest wetland area on Lake George at 9.6 acres. The shoreline is undeveloped along this stretch of emergent vegetation. Five plant species were observed from the boat, and others were undoubtedly present in innavigable areas of this wetland. Spatterdock and white lily were common in 1-4 feet of water, and cattails were abundant along the shoreline. Pickeral weed and softstem bulrush were also present in lower abundance near shore.

Emergent Bed #3
Size: 0.25 acres
Substrate: Silt/Sand
Number of Species: 5
Description: This plant bed is small at ¼ acre, but still contained five emergent species. White lily and spatterdock were common in this bed, as were cattails. Pickeral weed and softstem bulrush were also present in lower abundance.

8.2.2 Tier II Results

The fall 2006 Tier II survey was conducted on August 16, 2006. Historical secchi depth is approximately 10.0 to 11.0 feet. Eighty rake samples were distributed throughout Lake George, with an additional 5 samples being collected in Mill Pond. A total of 18 species of submersed aquatic plants were collected during the August 2006 Tier II survey. Of these 10 species, only one of them (Eurasian watermilfoil) was exotic. The following map shows the locations of all sample sites during the 2006 Tier II surveys.

Figure 4: Lake George Tier II Sample Sites



Tables 7 – 11 are data summaries for the 2006 Tier II vegetation survey on Lake George. These surveys help to describe the plant community, and will help identify any changes that take place in the years to come. Table 7 is a summary including every sample site on Lake George while Tables 8-11 describe the plant community in each 5 foot depth contour of the littoral zone (0-5 feet, 5-10 feet, etc).

Table 7: 2006 Fall Data Analysis: All Sites

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/16/06	Littoral sites with plants:	57	Species diversity:	0.91
Littoral depth (ft):	25.0	Number of species:	17	Native diversity:	0.90
Littoral sites:	80	Maximum species/site:	7	Rake diversity:	0.90
Total sites:	80	Mean number species/site:	2.51	Native rake diversity:	0.89
Secchi:	10.0	Mean native species/site:	2.23	*Mean rake score:	2.84

Common Name	Site frequency	Rel. Freq.	Relative density	Mean density	Dominance
Chara	42.5	16.9	0.85	2.00	17.0
Eurasian Watermilfoil	28.8	11.4	0.66	2.30	13.3
Eel Grass	26.3	10.4	0.44	1.67	8.8
Slender Naiad	25.0	10.0	0.35	1.40	7.0
Illinois Pondweed	23.8	9.5	0.41	1.74	8.3
Sago Pondweed	20.0	8.0	0.33	1.63	6.5
Whorled Watermilfoil	18.8	7.5	0.61	3.27	12.3
Bladderwort	15.0	6.0	0.20	1.33	4.0
Northern Watermilfoil	13.8	5.5	0.26	1.91	5.3
Brittle Naiad	11.3	4.5	0.24	2.11	4.8
Richardson's Pondweed	7.5	3.0	0.10	1.33	2.0
Coontail	6.3	2.5	0.18	2.80	3.5
Large-leaf Pondweed	3.8	1.5	0.04	1.00	0.8
Nitella	3.8	1.5	0.06	1.67	1.3
Leafy Pondweed	2.5	1.0	0.03	1.00	0.5
Flat-stemmed Pondweed	1.3	0.5	0.01	1.00	0.3
Waterstargrass	1.3	0.5	0.01	1.00	0.3

Table 8: Fall 2006 Data Analysis: 0-5 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/16/06	Littoral sites with plants:	19	Species diversity:	0.89
Littoral depth (ft):	5.0	Number of species:	13	Native diversity:	0.88
Littoral sites:	19	Maximum species/site:	7	Rake diversity:	0.88
Total sites:	19	Mean number species/site:	4.11	Native rake diversity:	0.87
Secchi:	10.0	Mean native species/site:	3.63	*Mean rake score:	4.47

Common Name	Site frequency	Relative density	Mean density	Dominance
Chara	73.7	1.47	2.00	29.5
Illinois Pondweed	63.2	1.16	1.83	23.2
Eel Grass	47.4	0.89	1.89	17.9
Eurasian Watermilfoil	47.4	1.00	2.11	20.0
Slender Naiad	42.1	0.53	1.25	10.5
Whorled Watermilfoil	26.3	0.89	3.40	17.9
Bladderwort	21.1	0.32	1.50	6.3
Brittle Naiad	21.1	0.42	2.00	8.4
Richardson's Pondweed	15.8	0.26	1.67	5.3
Northern Watermilfoil	15.8	0.26	1.67	5.3
Sago Pondweed	15.8	0.26	1.67	5.3
Large-leaf Pondweed	10.5	0.11	1.00	2.1
Leafy Pondweed	10.5	0.11	1.00	2.1

Table 9: Fall 2006 Data Analysis: 5-10 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/16/06	Littoral sites with plants:	18	Species diversity:	0.90
Littoral depth (ft):	10.0	Number of species:	15	Native diversity:	0.89
Littoral sites:	18	Maximum species/site:	7	Rake diversity:	0.89
Total sites:	18	Mean number species/site:	3.56	Native rake diversity:	0.88
Secchi:	10.0	Mean native species/site:	3.28	*Mean rake score:	4.00

Common Name	Site frequency	Relative density	Mean density	Dominance
Chara	72.2	1.50	2.08	30.0
Slender Naiad	38.9	0.61	1.57	12.2
Sago Pondweed	33.3	0.44	1.33	8.9
Bladderwort	27.8	0.28	1.00	5.6
Brittle Naiad	27.8	0.61	2.20	12.2
Eurasian Watermilfoil	27.8	1.06	3.80	21.1
Eel Grass	22.2	0.44	2.00	8.9
Northern Watermilfoil	22.2	0.44	2.00	8.9
Whorled Watermilfoil	22.2	0.44	2.00	8.9
Richardson's Pondweed	16.7	0.17	1.00	3.3
Illinois Pondweed	16.7	0.39	2.33	7.8
Coontail	11.1	0.33	3.00	6.7
Flat-stemmed Pondweed	5.6	0.06	1.00	1.1
Large-leaf Pondweed	5.6	0.06	1.00	1.1
Waterstargrass	5.6	0.06	1.00	1.1

Table 10: Fall 2006 Data Analysis: 10-15 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/16/06	Littoral sites with plants:	14	Species diversity:	0.89
Littoral depth (ft):	15.0	Number of species:	11	Native diversity:	0.89
Littoral sites:	17	Maximum species/site:	6	Rake diversity:	0.88
Total sites:	17	Mean number species/site:	2.65	Native rake diversity:	0.87
Secchi:	10.0	Mean native species/site:	2.18	*Mean rake score:	3.06

Common Name	Site frequency	Relative density	Mean density	Dominance
Eurasian Watermilfoil	47.1	0.82	1.75	16.5
Chara	35.3	0.59	1.67	11.8
Eel Grass	35.3	0.47	1.33	9.4
Northern Watermilfoil	23.5	0.47	2.00	9.4
Sago Pondweed	23.5	0.59	2.50	11.8
Whorled Watermilfoil	23.5	0.82	3.50	16.5
Slender Naiad	23.5	0.24	1.00	4.7
Illinois Pondweed	17.6	0.18	1.00	3.5
Bladderwort	11.8	0.24	2.00	4.7
Coontail	11.8	0.24	2.00	4.7
Nitella	11.8	0.24	2.00	4.7

Table 11: Fall 2006 Data Analysis: 15-20 Foot Depth Contour

Occurrence and Abundance of Submersed Aquatic Plants

Date:	8/16/06	Littoral sites with plants:	6	Species diversity:	0.88
Littoral depth (ft):	20.0	Number of species:	10	Native diversity:	0.86
Littoral sites:	16	Maximum species/site:	6	Rake diversity:	0.82
Total sites:	16	Mean number species/site:	0.88	Native rake diversity:	0.81
Secchi:	10.0	Mean native species/site:	0.81	*Mean rake score:	1.13

Common Name	Site frequency	Relative density	Mean density	Dominance
Sago Pondweed	18.8	0.19	1.00	3.8
Eel Grass	12.5	0.13	1.00	2.5
Whorled Watermilfoil	12.5	0.63	5.00	12.5
Bladderwort	6.3	0.06	1.00	1.3
Chara	6.3	0.19	3.00	3.8
Coontail	6.3	0.25	4.00	5.0
Eurasian Watermilfoil	6.3	0.06	1.00	1.3
Illinois Pondweed	6.3	0.06	1.00	1.3
Nitella	6.3	0.06	1.00	1.3
Slender Naiad	6.3	0.19	3.00	3.8

No plants were found in the 20 -25 foot depth contour.

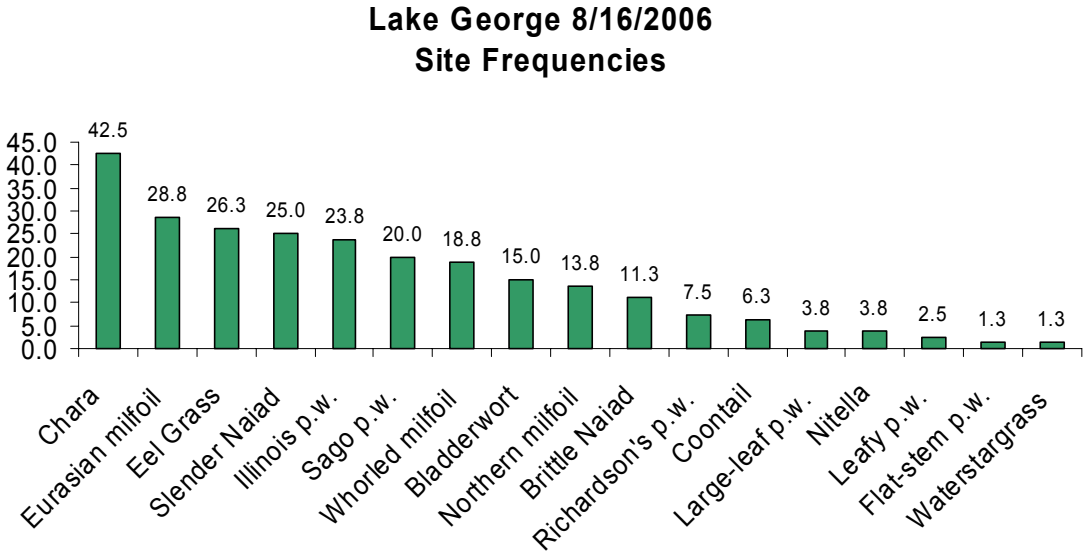
Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{(\text{\# of sites where the species was collected})}{\text{Total \# of littoral sample sites}} \times 100$$

Table 12 shows site frequencies for every plant collected in the August Tier II survey. Chara was the most frequently collected plant, at 42.5% of the sample sites. Eurasian watermilfoil was second at 28.8 %, and eelgrass was third at 26.3%. Whorled watermilfoil, a native plant that looks very similar to Eurasian watermilfoil was collected at 18.8 percent of the sample sites.

Table 12: 2006 Site Frequencies



Mean Density and Relative Density

Mean Density is a measure the abundance of a species in areas where it is growing. For example, a species can have a high site frequency, but still have a very low mean density. This means that a species may be prevalent throughout an entire lake, but it may also be sparsely scattered. Mean density can be calculated using the following equation:

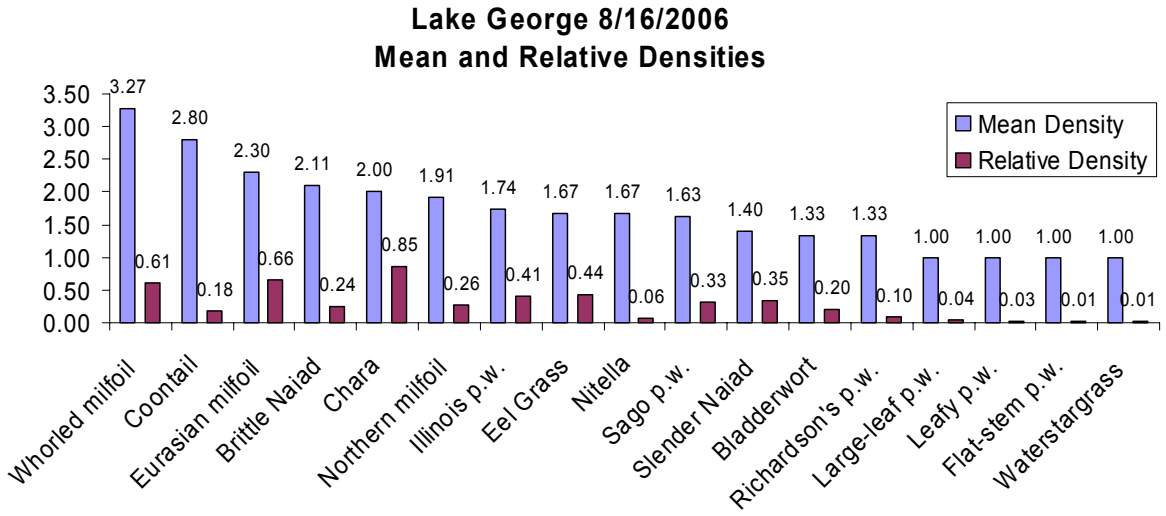
$$\text{Mean Density} = \frac{(\text{The sum of all rake scores for a species})}{(\text{Total \# of sites where the species was collected})}$$

Relative Density is calculated much like mean density, only in this case, the sum of the rake scores for a species is divided by the total number of sample sites in the survey. Unless a species was collected at every sample site, the relative density will always be smaller than the mean density.

$$\text{Relative Density} = \frac{\text{(The sum of all rake scores for a species)}}{\text{(Total \# of littoral sample sites)}}$$

Table 13 shows mean and relative densities in August of 2006. Whorled watermilfoil grows in dense pockets and had the highest mean density 3.27. Chara had a mean density of 2.0 but had the highest relative density, because it was collected so frequently. Eurasian watermilfoil had the third highest mean density and the second highest relative density at 2.30 and 0.66 respectively.

Table 13: 2006 Mean and Relative Densities



Species Diversity

The species diversity indices listed in Tables 7 through 11 help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty (H). If a species is chosen at random from a collection containing a certain number of species, the diversity index (H) is the probability that a chosen species will be different from the previous random selection. The diversity index (H) will always be between 0 and 1. The higher the H value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

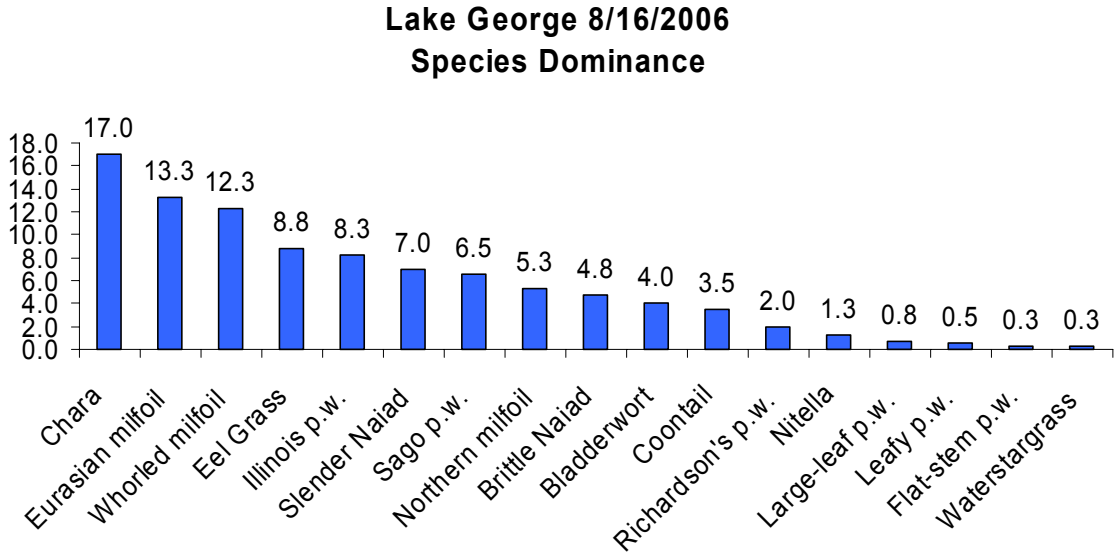
The species diversity index for Lake George in the August survey was 0.91 which is high when compared to many area lakes. Native plant diversity in the August survey was measured at 0.90. This value is only slightly lower than the total species diversity, meaning that native plants account for most of the diversity in Lake George. Rake diversity was measured at 0.90 as well and native rake diversity was slightly lower at 0.89.

Species Dominance

Species dominance is dependent upon how many times a species occurs, and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Table 14 shows dominance values for each plant collected in the August 2006 Tier II survey. Chara was the most dominant plant in the survey with a score of 17.0. Eurasian watermilfoil was the second most dominant plant in the survey at 13.3. Whorled watermilfoil dominance was very close to Eurasian watermilfoil dominance at 12.3. Eelgrass was the fourth most dominant plant in the fall survey, although it was not prevalent in the spring Tier I survey.

Table 14: 2006 Dominance Values



Relative Frequency of Occurrence

Relative frequency of occurrence is a measure of how often a plant is collected in relation to all of the other plants collected in a Tier II survey. It is demonstrated with the following equation:

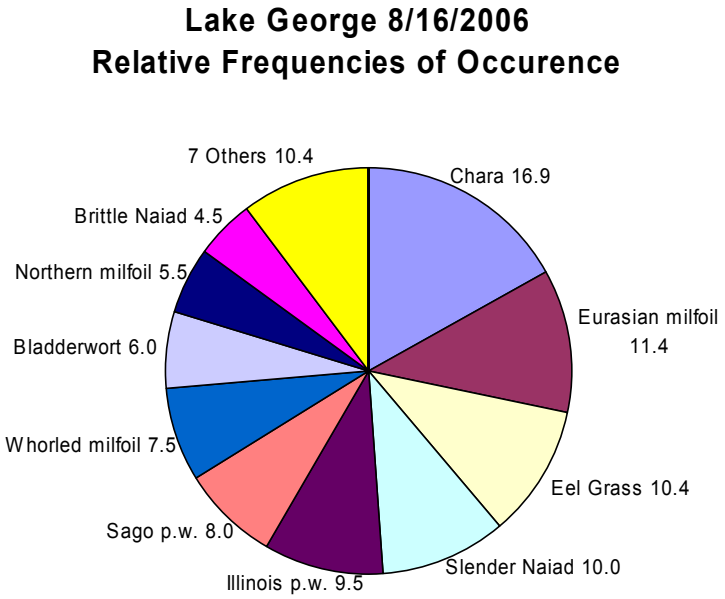
$$\text{Relative Freq. of Occurrence} = \frac{\text{The site Frequency for a species}}{\text{The sum of all site frequencies including the species in question}} * 100$$

The sum of all relative frequency of occurrence values will always add up to 100. For this reason it is displayed in a pie graph.

Table 15 shows relative frequency values for each plant collected in the August 2006 survey. The lake is divided evenly among species when compared to many Indiana lakes. Chara had

the highest relative density at 16.9, while Eurasian watermilfoil was second at 11.4. Eelgrass was third at 10.4, and slender naiad was fourth at 10.0.

Table 15: 2006 Relative Frequencies of Occurrence



8.3 Macrophyte Inventory Discussion

The submersed plant community of Lake George covers roughly 302 acres of the lake, or 59% of the lake's total surface area. Significant wetland areas cover only about 10.25 acres, both in the lake, and on the surrounding shoreline area. Of the 302 acres covered with submersed plants, Eurasian watermilfoil is widely distributed, being found in 5 of the 7 plant beds.

Based upon 2006 survey data, Lake George has highly diverse submersed aquatic plant community when compared with many area lakes. Species richness in Lake George was 18 species in the fall of 2006. The plant community is dominated by chara, Eurasian watermilfoil and whorled watermilfoil. In the fall eelgrass became very prevalent as well.

As more data is collected in the years to come, long term trends can be identified, and the health of the plant community can be more closely tracked. Eurasian watermilfoil has been present in the lake for many years, and has obviously increased to nuisance levels in some areas of the lake. Future surveys will track success of the management program by monitoring both Eurasian watermilfoil and native plant populations.

In summary, Lake George is characterized by a highly diverse submersed plant community (0.91), good water quality and clarity (secchi depth ~10.0 feet) and a widespread, patchy distribution of Eurasian watermilfoil.

9.0 Aquatic Plant Management Alternatives

Lake George currently has Eurasian watermilfoil distributed throughout the lake. Eurasian milfoil is believed to have arrived in North America in the mid 1940's and has spread throughout the east coast to northern Florida and the Midwest. Eurasian milfoil spreads by fragmentation and seed dispersal, and it has the ability to over-winter from year to year. Once it is in a lake it can become the dominant plant species because it forms dense canopies which shade out the native, more beneficial plant species below. There is also increasing evidence that mat forming species like Eurasian milfoil and curly leaf pondweed exert significant negative impacts on a broad range of aquatic organisms (Pullman, 1998)

Many management strategies have been used to control Eurasian milfoil in Indiana lakes. A management strategy should be chosen based on its selectivity of the pest in question, its long term effectiveness, and its environmental risks, The main goal of this plan is to choose a management option that can effectively control the Eurasian milfoil with little or no environmental risk, while causing no harm to native plant or fish species.

9.1 No Action

If no action is taken, the Eurasian milfoil abundance will increase from year to year. Eurasian milfoil grows by fragmentation, meaning that if the plant is cut, the fragment has the ability to form an entirely new plant. Eurasian milfoil also over-winters as an adult plant so new generations are created in each growing season. These reproductive characteristics cause milfoil beds become more dense over time, which can create a monoculture as it may eliminate more and more native species from a lake.

9.2 Institutional-Protection of Beneficial Vegetation

Lake users can play an important role in the protection of beneficial aquatic vegetation. Aquatic invasive species often gain a foothold in an ecosystem in areas disturbed by human activity or natural processes. In many cases, boating may be restricted in certain areas of a lake to prevent harm to native plants, especially many emergent species. Boating lanes may be established through areas of emergent vegetations, and protected ecological zones may be created to prevent erosion off shoreline vegetation caused by intense wave action from boating activities. Shallow areas of a lake may also be marked with buoys to prevent injury to boaters and water skiers. It is important to obey boating restrictions to protect beneficial plant species and even prevent personal injury.

A healthy aquatic plant community is absolutely essential for the maintenance of a stable, diverse ecosystem. Aquatic plants provide habitat for plankton, insects, crustaceans, fish, and amphibians. They take nutrients like phosphorus and nitrogen out of the water column, increase water clarity, prevent harmful algal blooms, produce oxygen and provide food for waterfowl. Aquatic plants can even remove pollutants from contaminated water, and prevent the suspension of particulate matter by stabilizing sediment and preventing erosion from wave action or current.

The LARE aquatic vegetation management program recognizes the importance of beneficial aquatic vegetation and its protection is a top priority. The most basic goal for the LARE aquatic vegetation program is to maintain healthy aquatic ecosystems by maintaining or

improving biodiversity in Indiana lakes. The purpose of conducting aquatic vegetation surveys is to document the overall health of plant communities and identify any ecosystem whose stability is threatened by invasive plant species.

Once a problem area is identified, a management strategy must be formulated that directly impacts the aquatic plant community in a positive way. While eradicating invasive plants is a major component of many management strategies, it is important to note the ultimate goal is not to eradicate aquatic vegetation, but to protect beneficial vegetation and protect lake ecosystems.

9.3 Environmental Manipulation

9.3.1 Water Level Manipulation

Draw down of the lake water level is one option that may help the Eurasian milfoil problem. Lower water levels expose the Eurasian milfoil roots to freezing and thawing, which may kill may kill milfoil root systems. However, a lake draw down will not only kill Eurasian milfoil, but native plants as well. Also, reducing the lake level would make new areas of the lake available for vegetative growth, and Eurasian milfoil may have an advantage in the colonization of these new areas if it is not eradicated prior to the lake draw down.

9.3.2 Nutrient Reduction

Limiting factors for plant growth include light, lake morphometry and depth, substrate and the availability of nutrients like phosphorus and nitrogen. While lake morphometry is most highly correlated with plant biomass, the availability of phosphorus and nitrogen have a tremendous impact on the amount of plant growth in a body of water. If the vast majority of phosphorus in a system is tied up in plant matter, it may be difficult for an invasive species to gain a foothold and spread rapidly in the lake. If phosphorus is constantly being added to the system and is readily available in the water, then invasive species will have an unlimited food supply should a disturbance create the opportunity for them to proliferate in a body of water.

Phosphorus and nitrogen are added to aquatic systems by many natural sources, such as the decomposition of plant material, and animal waste, but human activity is often responsible for excessive phosphorus loading that contributes to blue-green algal blooms, overabundant vegetation growth and a general decline in water quality. Major contributions of excess phosphorus come from sources such as septic system inputs, agricultural runoff, storm water drainage, lawn fertilizer applications, , and improper disposal of grass clippings and tree leaves. Owners of lake front property can significantly reduce the amount of phosphorus entering the lake by taking actions outlined in the public education section.

www.epa.gov

9.4 Mechanical Controls

9.4.1 Mechanical Cutting and Harvesting

www.cleanlake.com

Mechanical harvesting uses a large machine to cut and collect unwanted aquatic plants. These machines pick up the cut weeds but will still leave small fragments that will have the ability to re-grow. Also, after an area is harvested the Eurasian milfoil generally re-grows first causing the native plants to be shaded out again. Mechanical harvesting is also not selective in its control. The harvesting will cut the native plant species as well as the exotics if both are present in the same area. For these reasons, mechanical harvesting is not recommended. Harvesting can be accomplished by individual owners around their dock areas. A lake property owner can legally harvest a 625 square foot area. (25 feet by 25 feet). An IDNR permit is required for the use of mechanical harvester on public waters.

9.5 Manual Controls

9.5.1 Hand Pulling, Cutting, Raking

www.ecy.wa.gov

Manual controls such as hand pulling, cutting and raking can be effective ways to control unwanted plants in certain situations. In very shallow clear water, small areas of vegetation can identified and cleared effectively by hand. Large areas of vegetation, especially those in deeper water can be extremely difficult to control using these methods. Many of the harvested weeds will break apart, leaving the root system in the lake bottom. Failure to remove root structures will result in re-growth.

Plants that possess the ability to reproduce through fragmentation can seldom be effectively controlled by these methods if they are distributed throughout a lake. Identifying every area of infestation would be difficult, as would harvesting the plants without causing fragmentation of individual plants. Any plant fragments not removed from the water can form new plants, meaning that hand pulling and cutting can facilitate the spread of the unwanted plant species.

9.5.2 Bottom Barriers

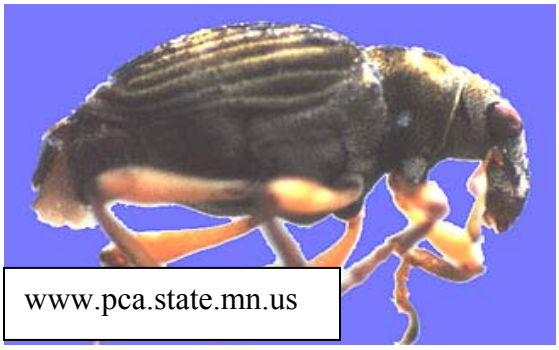
Bottom Barriers prevent the growth of aquatic plants by lining the bottom of a lake or pond with a material that prohibits light from reaching the lake bottom and that is difficult for plants to penetrate. Many times, plastic or concrete barriers are used to prevent the growth of aquatic vegetation during construction of a lake or pond. This from of control is best implemented during construction of a new pond, and placing a bottom barrier in an existing lake would involve significant challenges and be extremely expensive. A draw down of the lake may be necessary install the barrier, and if the lake level is not regulated by control structures, this can be almost impossible. For a large lake, material costs alone would be enormous.


www.ecy.wa.gov

Once in place, the barrier would prevent not only invasive plant growth, but native plant growth as well, destabilizing the lake ecosystem and having a negative impact on insect and fish communities. Sediment would gradually accumulate on top of the barrier, and aquatic plant growth would return as plants begin to take root in the sediment on top of the barrier. An IDNR permit is required for the placement of a bottom barrier on public waters.

9.6 Biological Controls

9.6.1 Water Milfoil Weevil


www.pca.state.mn.us

The water milfoil weevil is a native North American insect that consumes Eurasian milfoil and northern milfoil. The weevil was discovered after a decline in the Eurasian milfoil population was observed in Brownington Pond, Vermont (Creed and Sheldon, 1993). The milfoil weevil burrows down into the stem of the plant and consumes the tissue of the plant. Holes in the milfoil stem bored by weevil larvae allow disease to enter the plant. These same holes also cause a release of the plants' gases which reduces buoyancy and causes the plant to sink (Creed et. Al. 1992).

Studies conducted to evaluate the effectiveness of the water milfoil weevil have not yielded consistent results. Factors influencing the weevil's success or failure in a body of water are not well documented. In 2003, Scribailo and Alix conducted a weevil test on Round Lake in Indiana and found no conclusive evidence that the Eurasian milfoil populations were reduced. An IDNR Permit is required for the stocking of watermilfoil weevils.

9.6.2 Grass Carp

www.tpwd.state.tx.us

The Asian grass carp or white amur (*Ctenopharyngodon idella*) is an herbivorous fish that is native to eastern Russia and China. This fish has been introduced into the U.S. to help control aquatic vegetation. To prevent their uncontrolled proliferation, all fish stocked in Indiana must be triploid, meaning that they cannot reproduce. Stocking is restricted to privately owned bodies of water, and suppliers must obtain a special permit from the IDNR. Grass carp are completely vegetarian, feeding on many species of submersed plants, along with some floating plants such as duckweed. Hydrilla, a highly invasive plant found in many southern states is a preferred food of grass carp and efforts to control hydrilla with grass carp have been successful.

According to the Aquatic Ecosystem Restoration Foundation, grass carp avoid Eurasian milfoil, and show strong preferences for many native plants along with hydrilla. The success of grass carp stockings is highly dependent upon the food sources available to the fish. When Eurasian milfoil occurs along with native plant populations, grass carp are not recommended. Currently in Indiana it is illegal to stock grass carp in public waters.

9.7 Chemical Controls

9.7.1 Aquatic Herbicides

There are two major categories of aquatic herbicides: contact and systemic herbicides. Contact herbicides are used best to control the majority of the weeds close to shore, around piers and in man-made channels. Examples of contact herbicides are Reward (active ingredient: diquat), and Aquathal (active ingredient: endothal).

Contact herbicides would not be a wise choice for a whole lake treatment because of their lack of selectivity and their inability to eliminate the root systems of treated plants. These characteristics could result in unnecessary damage to native species, as well as greater potential for the re-infestation of Eurasian milfoil.

Systemic herbicides are absorbed by the plant and transported to the root systems where they eliminate both the roots and the plant. Examples of systemic herbicides are Sonar and Avast (active ingredient: fluridone), Navigate, Aqua Kleen, DMA4 (active ingredient 2, 4-D) and Renovate (active ingredient: triclopyr). All of these chemicals effectively kill Eurasian milfoil plants and roots. Based on the author's experience and other lake managers in the Midwest, whole lake treatments using fluridone are the most effective way to control Eurasian water milfoil in lakes that have become severely infested. Fluridone can be applied at low rates to control the Eurasian milfoil while causing little or no harm to the majority of the native weed species present in the lake.

2, 4-D and triclopyr are both root control herbicides which can to be used for spot treatments in small areas of Eurasian milfoil infestation, while the whole lake must be treated if fluridone is used. The major difference between 2, 4-D and triclopyr is that triclopyr is showing that it may have the ability to control the Eurasian milfoil in select areas longer than

2,4-D. Renovate (triclopyr) has only been available for use for the past three seasons, and the ability of Renovate to provide more long term control of Eurasian milfoil than 2,4-D in spot treatment situations is still being documented. 2, 4-D is less expensive to use but if triclopyr continues to show better long term control in treated areas it will may become the most cost effective long term investment.

The public's primary concern with the use of aquatic herbicides is safety. Every chemical registered for aquatic applications has undergone extensive testing prior to becoming available for use. These tests demonstrate that when these herbicides are applied properly at labeled rates, they are safe for humans and will not cause any adverse environmental effects.

10.0 Public Involvement

A public meeting for this project was held on September 9, 2006. Thirty-one people were in attendance. Lake residents were pleased that the LARE grant application process was moving in the right direction. They also expressed frustration that Indiana and Michigan agencies could not reach a compromise for permitting a whole lake treatment. Questionnaires were handed out to all in attendance at the 2006 public meeting. Data was compiled and the original questionnaire was used to show a summary of all responses.

Table 16: 2006 Lake George Public Questionnaire

Total: 31

Lake Use Survey — Lake name George

Are you a lake property owner? Yes 31 No 0

Are you currently a member of your lake association? Yes 30 No 1

How many years have you been at the lake?
2 or less - 0
2 – 5 years - 1
5-10 years - 3
Over 10 years - 27

How do you use the lake (mark all that apply)

29 Swimming	17 Irrigation
31 Boating	0 Drinking water
27 Fishing	2 Other view

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 27 No 4

Do you currently participate in a weed control project on the lake? Yes 21 No 10

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 26 No 4

Does the level of vegetation in the lake affect your property values? Yes 24 No 3

Are you in favor of continuing efforts to control vegetation on the lake? Yes 30 No 0

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 29 No 2

Mark any of these you think are problems on your lake:

6	Too many boats access the lake
6	Use of jet skis on the lake
0	Too much fishing
6	Fish population problem
7	Dredging needed
7	Overuse by nonresidents
19	Too many aquatic plants
0	Not enough aquatic plants
2	Poor water quality
3	Pier/funneling problem

Please add any comments:

Dredging needed in certain areas; need to get together with one plan to do weeds for the whole lake as a group; too many bass tournaments "they bring in foreign weeds" + don't respect our lake and fish; the level of vegetation in the lake could affect our property value in the future;

11.0 Public Education

Lake residents play an important role in establishing and maintaining a healthy lake community. Lake association meetings and newsletters are excellent avenues through which this information about management practices on Lake George can be distributed. These meetings can also help to inform the public about practical steps that they can take to improve Lake George. The following information is designed to give practical suggestions on ways that lake residents can reduce nutrient loading and improve the Lake George ecosystem.

1. **Ensure that existing homes be connected to a properly maintained lake wide sewer system if possible.** Many older homes possess septic systems without proper filter beds. Some systems may have significant leaks, while some may drain into the lake. Sewage leaks add tremendous amounts of nutrients to the water, along with harmful bacteria.

2. **Limit lawn fertilizer use in areas where runoff will enter the lake.** If a fertilizer application must be applied, avoid spreading fertilizer directly into the lake, on sidewalks, or sea walls where it will wash into the lake. Try to avoid applying fertilizer within 30 feet of the lakeshore. If fertilizer must be used, low phosphorus or no phosphorus fertilizer is recommended.

3. **Work with farmers within the lake catchment to increase proper filtration and drainage of agricultural land before runoff reaches the lake.** The Indiana state government offers incentives for farmers to address soil and water concerns through the U.S. Department of Agriculture. The Indiana Conservation Reserve Program (CRP) provides technical and financial aid to reduce soil erosion, reduce sediment in lakes and streams, and improve overall water quality. Farmers owning highly erodable land or property adjacent to tributary streams or lakes may be eligible for funding that can increase water quality significantly. Further information can be found at www.in.nrcs.usda.gov/programs/CRP/crphomepage.html or by contacting the following address.

   Indiana NRCS
   6013 Lakeside Boulevard
   Indianapolis, Indiana 46278-2933
   Phone: (317) 290-3200
   FAX: (317) 290-3225

4. **Avoid blowing grass clippings and tree leaves into the lake**. Many pond owners know that grass clippings blown into a pond can turn into a floating mat of algae in only a few days. This occurs because cut and decaying vegetation rapidly releases nutrients into the water.

5. **Prevent or reduce urban and industrial runoff flowing directly into the lake.** Urban runoff can be one of the most detrimental factors influencing water quality. Not only are nutrients and sediment carried to lakes through storm sewers, but harmful contaminants as well. Oil, antifreeze, gasoline, road salt, and other

pollutants are washed from pavement and can all end up harming a lake ecosystem.

The following are practical steps recommended by the United States Environmental Protection Agency to reduce urban runoff:

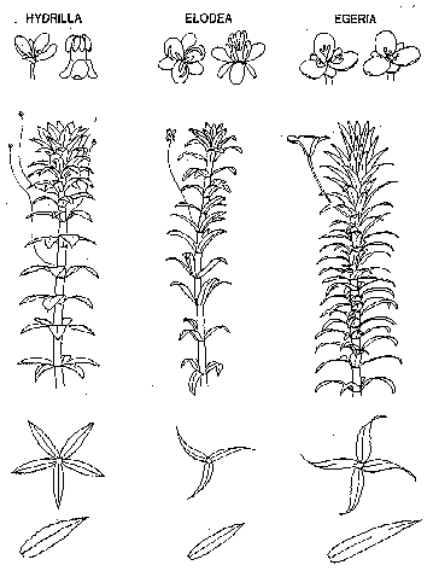
a) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss.
b) Limit land disturbance such as clearing and grading and cut fill to reduce erosion and sediment loss.
c) Limit disturbance of natural drainage features and vegetation.
d) Place bridge structures so that sensitive and valuable aquatic ecosystems are protected.
e) Prepare and implement an approved erosion control plan.
f) Ensure proper storage and disposal of toxic material.
g) Incorporate pollution prevention into operation and maintenance procedures to reduce pollutant loadings to surface runoff.
h) Develop and implement runoff pollution controls for existing road systems to reduce pollutant concentrations and volumes.

Further information about urban runoff in Indiana can be obtained by contacting the EPA Region 5 National Pollution Discharge Elimination System Storm Water Coordinator by calling (312) 886-6100.

6. **Establish ecological zones to protect existing wetlands and emergent vegetation from turbulence caused by boats.** Wetlands not only filter water, but they also stabilize shoreline areas that would otherwise be highly erodable. Submersed and emergent vegetation can be eliminated by heavy wave action, which destabilizes the shoreline and reduces the lake's natural defense against sediment and nutrient loading. It is extremely important to make sure that existing wetlands remain intact to aid in the natural water purification process. If possible lake associations should identify significant wetland areas and work with the IDNR to protect them from drainage and disruption.

11.1 Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is listed as a federally noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader. In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, the closest infestations of hydrilla were in Tennessee and Pennsylvania.



Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Treatment Action Strategy

Given Eurasian watermilfoil abundance in Lake George, funding may be awarded by the LARE program to chemically treat areas of infestation. Herbicide treatment options for selective, root control of Eurasian watermilfoil include Sonar (active ingredient: fluridone), Renovate (active ingredient triclopyr), and 2, 4-D. Sonar treatments provide the most complete control of Eurasian watermilfoil and can also provide multiple years of control. Renovate and 2, 4-D, while very effective, are normally applied to the same areas on a yearly basis to provide control.

Aquatic Weed Control recommends the use of Sonar to control Eurasian watermilfoil in Lake George. This will provide the most effective control and should be the most cost effective long term management strategy. However, based on meetings with IDNR fisheries and LARE biologists, as well as permitting and herbicide calculation issues in the state of Michigan, Lake George will not be considered a candidate for a whole lake Sonar treatment in 2007.

The 2007 treatment plan will use Renovate to provide control of Eurasian watermilfoil along sections of shoreline in the Indiana waters of Lake George. Exact treatment areas will depend upon results of a spring 2007 vegetation survey, and up to 62 acres of Lake George may be treated to reduce the Eurasian watermilfoil population.

It is important to note that Eurasian watermilfoil will be the only plant species specifically targeted in this project, as LARE funds can only be awarded for the control of invasive plant species. The goal is not to eliminate vegetation in Lake George, but to improve the health of the plant community by reducing the Eurasian watermilfoil population.

Native vegetation will still be abundant in shallow areas after treatment, and control of these natives must be privately funded. The goal will be to reduce the Eurasian watermilfoil population and allow for the recovery of native plant species that will provide better fish habitat, foster good water quality and pose less interference to recreational use of the lake.

13.0 Project Budget

Cost estimates for this project are included below. These figures are estimates only and are subject to change pending 2007 chemical pricing.

Project	Total Cost	LARE Share	Association Share
Treat up to 62 acres along Indiana's shoreline with Renovate for Eurasian watermilfoil	Up to $28,830	Up to $25,947	Up to $2,883
2007 Plant Surveys and Plan update	Up to $4,000	Up to $3,600	Up to $400
Totals	$32,830	$29,547	$3,283

Survey and planning costs

Four thousand dollars are currently budgeted for surveying and planning but this cost may be reduced pending 2007 LARE surveying and planning requirements.

14.0 Monitoring and Plan Update Procedures

In spring of 2007, a Tier II vegetation survey should be conducted to confirm the distribution of Eurasian watermilfoil prior to chemical treatment. It is recommended that a late season Tier II survey be conducted on Lake George as well in 2007 to monitor changes in the plant community as a result of the herbicide treatment. This survey should be conducted in late summer or early fall to allow the slow acting herbicides to achieve full control before the survey is conducted.

In the years that follow, additional surveys should be conducted to determine how the Eurasian milfoil population is reacting to the management strategy over a long period of time. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the need arise to modify the management strategy. They will also serve to keep the public interested and informed about management practices at the lake so they will be motivated and equipped to actively participate in the conservation of the Lake George ecosystem. The intensity and frequency of vegetation surveys may change from year to year. Survey and planning needs should be re-evaluated each year to reduce unnecessary cost to the lake association while still providing adequate data to characterize the plant community.

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16.0 Appendices

16.1 Calculations

Fluridone Calculations:

The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:
Quarts of Sonar A.S. required per treated surface acre = Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027
For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:
5 **x** 25 **x** 0.0027 = 0.33 quarts per treated surface acre
When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured **x** 32. For example, 0.33 quarts **x** 32 = 10.5 fluid ounces.
Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

16.2 Common Aquatic Plants of Indiana

The following appendix was compiled using information found in the 5th edition of How to Identify Water Weeds and Algae, edited by James C. Schmidt and James R. Kannenberg. All pictures, with the exception of Illinois pondweed and northern milfoil were taken from the Category 5 Aquatic Pest Control Management Manual, written by Dr. Carole Lembi, Head of the Department of Botany and Plant Pathology at Purdue University.

American Pondweed

Scientific name: *Potamogeton americanus*

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: American pondweed can be identified by its oval shaped leaves floating on the top of the water. The base of each leaf tapers to a very long petiole that connects the leaf with the stem of the plant. Plant leaves are arranged alternately on the stem and leaves are usually sparsely scattered.

Chara

Scientific name: *Chara sp*.

Classification: Native to Indiana

Distribution: Extremely common worldwide. Usually found in hard water.

Description: Chara is often mistaken for a vascular plant, but it is actually an advanced form of algae. It can be gray, green or yellow in color and is usually forms extremely dense beds that may cover an entire lake. It can be identified by its distinct musky odor and calcium deposits on the algae's surface make it feel bristly to the touch. It possesses leaf-like structures that are whorled around the hollow stem, and it attaches itself to the lake bottom, although it has no actual roots. It usually grows in shallow, clear water.

Coontail

Scientific name: *Ceratophyllum demersum*

Classification: Native to Indiana

Distribution: Common throughout the U.S., usually in hard water.

Description: Coontail plants are submersed and have no roots, though they appear to be attached to the lake bottom when viewed from above the surface of the water. The free-floating nature of coontail allows it to colonize new areas of a lake quickly, and it often times forms extremely dense weed beds where sufficient light and nutrients are available. Coontail has dark green leaves arranged in whorls around the stem and usually grows in long, bushy strands resembling evergreen trees beneath the surface of the water. Coontail's structure is very similar to Eurasian milfoil but coontail has forked leaves, which distinguishes it from the feather-like projections of milfoil leaves.

Curley Leaf Pondweed

Scientific name: *Potamogeton crispus*

Classification: Exotic to Indiana

Distribution: Found throughout the U.S. in fresh and brackish water.

Description: Curley leaf pondweed usually grows and spreads rapidly in early spring and begins to dies out by midsummer as water temperatures approach 70 degrees Fahrenheit. Curley leaf has extremely thin, membranous leaves arranged alternately on the stem with small teeth-like projections visible along the edge of each leaf. A reproductive spike may be seen protruding from the surface of the water. Curley leaf pondweed may also leave small reproductive structures called turions in the sediment on the lake bottom that can lie dormant throughout the winter and then sprout when spring arrives.

Eel Grass (Wild Celery)

Scientific name: *Vallisneria Americana*

Classification: Native to Indiana

Distribution: Found from the Great Plains to the East Coast of the U.S.

Description: Eel grass has tufts of ribbon-like leaves with a horizontal stem embedded in the sediment connecting each tuft. This native plant grows thick weed beds anchored in the mud by roots. These dense beds often shade out other forms of weeds and provide excellent escape cover for small fish. The flowers of this plant are visible in late summer and sit on the top of a coiled structure protruding to the surface. This plant is found in both lakes and river, but is seldom found in stagnant systems. It is considered an extremely valuable plant to aquatic ecosystems.

Elodea

Scientific Name: *Elodea Canadensis*

Classification: Native to Indiana

Distribution: Common throughout the north and north central united states. Its ranges extends as far south as northern Tennnessee.

Description: Elodea grows in long strands resembling milfoil, but its leaves are broad and oval shaped. Leaves are arranged in whorls with three leaves usually occurring at each node. Leaves near the tip of the plant are closely packed together, with the distance between nodes increasing further down the stem.

Eurasian Milfoil

Scientific Name: *Microphyllum spicatum*

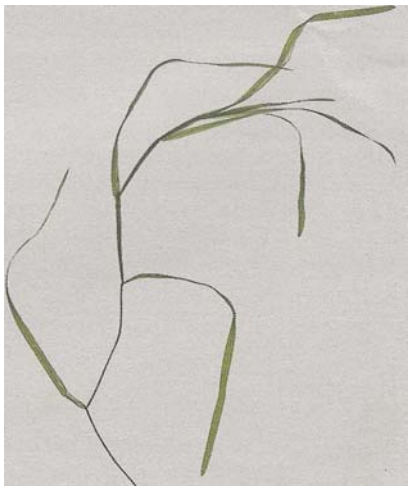
Classification: Exotic in Indiana

Distribution: Common in the Midwest and Eastern U.S. Also spreading along the Pacific coast

Description: This extremely aggressive and extremely destructive plant has leaves in whorls of 4 around a reddish stalk. This plant grows rapidly and can reach lengths of over 10 feet. This plant has the ability to over winter, meaning it can lie dormant during the winter months instead of dying out completely each year. This gives it a distinct advantage over many native species, as it competes for sunlight in early spring. The dormant milfoil plants reach the surface much faster than the native plants sprouting from the lake bottom. This enables the Eurasian milfoil to shade out other plants and form the dense beds that choke the littoral zone of many lakes.

A reproductive process called fragmentation aids the rapid dispersion of Eurasian milfoil. If a milfoil plant is damaged and some fragments are removed from the macrophyte, each small piece of the plant has the ability to grow roots and create a new milfoil plant. Eurasian milfoil is considered one of the most dangerous aquatic nuisance species because of its ability to rapidly disrupt and destroy lake ecosystems.

Flat-stemmed Pondweed



Scientific Name: *Potamogeton zosteriformis*

Classification: Native to Indiana

Distribution: Common throughout the northern half of the U.S.

Description: the most noticeable characteristic is the large, very flat stem. It cannot be rolled between the fingers easily. The ribbon-like leaves extend from the stem toward the surface of the water.

Illinois Pondweed

Scientific name: *Potamogeton illinoensis*

Classification: Native to Indiana

Distribution: Very widespread and very common throughout the upper Midwest and the U.S

Description: Illinois pondweed is common in Indiana, especially in the northern third of the state. This leafy weed has leaves with very broad bases that extend three-fourths of the way around the stem. The upper part of its slender stem is usually branched and very leafy.

www.wvu.edu

Large Leaf Pondweed

Scientific name: *Potamogeton amplifolius*
Classification: Native to Indiana
Distribution: Common throughout the upper Midwest and the northern United States in hard water.

Description: This plant has both submersed and floating leaves. The floating leaves are oval shaped and are similar to those of American pondweed. Submersed leaves are arranged alternately with each leaf becoming extremely narrow as it nears the stem of the plant. Mineral deposits on its leaves often give large leaf pondweed a dark brown appearance.

Naiad

Scientific name: *Najas minor* (brittle naiad)

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: The leaves of naiad plants are usually widest at the base and gradually become thinner near the tip of the leaf. Plants are extremely leafy and appear bush-like when viewed from above the surface of the water. Many species of naiad are very common in this area. Plant structure often resembles chara, but the absence of calcium deposits on the surface of the plant help in identification. The leaves of brittle naiad have multiple spines along the margins that are visible to the naked eye.

Nitella

Scientific name: *Nitella sp.*

Classification: Native to Indiana

Distribution: Found worldwide, usually in hard water.

Description: Nitella is very similar to chara, and it is also an advanced form of algae. It has leaf-like projections that are whorled around the stem. It is often found growing in very thick patches, usually in shallow, clear water.

Northern Milfoil

www.io.uwinnipeg.ca

Scientific name: *Myriophyllum sibericum*

Classification: Native to Indiana

Distribution: Found throughout the northern half of the U.S. and also in Europe and Western Asia

Description: Northern milfoil has submersed, feather-like, whorled leaves that closely resemble the leaves of Eurasian milfoil. Distinguishing the native northern milfoil from Eurasian milfoil can be difficult. The leaflet pairs of northern milfoil are generally fewer and more widely spaced than those of Erasian milfoil. This plant is known to hybridize with Eurasian milfoil, and at times, chemical analysis is necessary to distinguish between the two plants.

Sago Pondweed

Scientific name: *Potemogeton pectinatus*

Classification: Native to Indiana

Distribution: Found throughout the U.S., Common in the northern 2/3 of Indiana.

Description: Sago Pondweed has a bushy appearance with narrow, thread-like leaves that spread out to resemble a fan. Leaves are usually 1/16 of an inch wide and 1 to 6 inches long. Nutlets are formed on a string-like structure and protrude from the surface of the water. While sago pondweed can form dense beds, many times it is found in sparse, loosely distributed arrangements.

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major herbicides and algaecides available for use in the aquatics market.

Table 17: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.4 Public Input Questionnaire Data

Table 18: Public Questionnaire Sample

Lake Use Survey Lake name_____

Are you a lake property owner? Yes___ ____ No_____

Are you currently a member of your lake association? Yes ___ No___

How many years have you been at the lake?
2 or less
2 – 5 years
5-10 years
Over 10 years

How do you use the lake (mark all that apply)
___Swimming ___Irrigation
___Boating ___Drinking water
___Fishing ___Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ___ No ___

Do you currently participate in a weed control project on the lake? Yes ___ No ____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ___ No___

Does the level of vegetation in the lake affect your property values? Yes ___ No ___

Are you in favor of continuing efforts to control vegetation on the lake? Yes ___ No ___

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes ___ No ___

Mark any of these you think are problems on your lake:
___ Too many boats access the lake
___ Use of jet skis on the lake
___ Too much fishing
___ Fish population problem
___ Dredging needed
___ Overuse by nonresidents
___ Too many aquatic plants
___ Not enough aquatic plants
___ Poor water quality
___ Pier/funneling problem

Please add any comments:
_____
_____
_____

16.5 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.6 Indiana State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:

(1) A privately owned lake, farm pond, or public or private drainage ditch.

(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:

(A) The area where vegetation is to be controlled does not exceed:

(i) twenty-five (25) feet along the legally established, average, or normal shoreline;

(ii) a water depth of six (6) feet; and

(iii) a total surface area of six hundred twenty-five (625) square feet.

(B) Control of vegetation does not occur in a public waterway of the state.

(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.

(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.

(d) This section does not do any of the following:

(1) Act as a bar to a suit or cause of action by a person or governmental agency.

(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.

(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).

As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits

Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.

(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:

(1) The common name of the plants to be controlled.

(2) The acreage to be treated.

(3) The maximum depth of the water where plants are to be treated.

(4) The name and amount of the chemical to be used.

(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.7 Michigan Regulations Pertaining To Lake Improvements and Special Assesments

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT (EXCERPT)
Act 451 of 1994
PART 33
AQUATIC NUISANCE CONTROL

324.3301 Definitions; A to D.

Sec. 3301. As used in this part:
(a) "Aquatic nuisance" means an organism that lives or propagates, or both, within the aquatic environment and that impairs the use or enjoyment of the waters of the state, including the intermediate aquatic hosts for schistosomes that cause swimmer's itch.
(b) "Certificate of coverage" means written authorization from the department to implement a project under a general permit.
(c) "Department" means the department of environmental quality.
(d) "Director" means the director of the department.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Compiler's note: Former PART 33 was entitled "CONTAMINATION OF WATERS." Former MCL 324.3301, which pertained to disposal of refuse from fish catch, was repealed by Act 27 of 1996, Imd. Eff. Feb. 26, 1996.
Popular name: Act 451

324.3302 Definitions; G to W.

Sec. 3302. As used in this part:
(a) "General permit" means a permit for a category of activities that the department determines will not negatively impact human health and will have no more than minimal short-term adverse impacts on the natural resources and environment.
(b) "Lake management plan" means a document that contains all of the following:
(*i*) A description of the physical, chemical, and biological attributes of a waterbody.
(*ii*) A description of the land uses surrounding a waterbody.
(*iii*) A detailed description of the historical and planned future management of the waterbody.
(c) "Violation of this part" means a violation of a provision of this part or a permit, certificate of coverage, or order issued under or rule promulgated under this part.
(d) "Waters of the state" or "waterbody" means groundwaters, lakes, ponds, rivers, streams, and wetlands and all other watercourses and waters within the jurisdiction of this state including the Great Lakes bordering this state.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Compiler's note: Former MCL 333.3302, which pertained to nonresident license to use pound or trap net, fee, and violation, was repealed by Act 27 of 1996, Imd. Eff. Feb. 26, 1996.
Popular name: Act 451

324.3303 Chemical treatment of waters for aquatic nuisance control; permit or certificate of coverage required; exception; records; qualifications; authorization under part 31.

Sec. 3303. (1) Subject to subsections (2), (4), and (5), a person shall not chemically treat either of the following for purposes of aquatic nuisance control unless the person has obtained from the department an individual permit or a certificate of coverage under this part:
(a) Any waters of the state, if water is visibly present or contained in the area of impact at the time of chemical treatment.
(b) The Great Lakes or Lake St. Clair if the area of impact is exposed bottomland located below the ordinary high-water mark.
(2) Subject to subsections (3), (4), and (5), a person may chemically treat waters of the state for purposes of aquatic nuisance control without obtaining from the department an individual permit or a certificate of coverage if all of the following criteria are met:
(a) The waterbody does not have an outlet.
(b) There is no record of species on a list of endangered or threatened species referred to in part 365.
(c) The waterbody has a surface area of less than 10 acres.
(d) If the bottomlands of the waterbody are owned by more than 1 person, written permission for the proposed chemical treatment is obtained from each owner.
(e) The person posts the area of impact in the manner provided in section 3310(d).

(3) A person conducting a chemical treatment authorized under subsection (2) shall maintain any written permissions required under subsection (2) and records of treatment, including treatment date, chemicals

applied, amounts applied, and a map indicating the area of impact, for 1 year from the date of each chemical treatment. The records shall be made available to the department upon request.
(4) A person shall not apply for a permit or certificate of coverage under subsection (1) or conduct a chemical treatment described in this section unless the person is 1 or more of the following:
(a) An owner of bottomland within the proposed area of impact.
(b) A lake board established under part 309 for the affected waterbody.
(c) A state or local governmental entity.
(d) A person who has written authorization to act on behalf of a person described in subdivision (a), (b), or (c).
(5) The chemical treatment of waters authorized pursuant to part 31 is not subject to this part.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Compiler's note: Former MCL 324.3303, which pertained to unlawful dumping into waters and molesting of nets, was repealed by Act 27 of 1996, Imd. Eff. Feb. 26, 1996.
Popular name: Act 451

324.3304 Lake management plan as part of permit application; proposal for whole lake evaluation treatment; placement of specific conditions in permit; scientific rationale for permit denial.

Sec. 3304. (1) An applicant shall provide a lake management plan as part of an application for permit, if a whole lake treatment is proposed.
(2) An applicant for a permit for a whole lake evaluation treatment may provide scientific evidence and documentation that the use of a specific pesticide, application rate, or means of application will selectively control an aquatic nuisance but not cause unacceptable impacts on native aquatic vegetation, other aquatic or terrestrial life, or human health. Such evaluation treatments include the use of fluridone at rates in excess of 6 parts per billion. The department may place special conditions in a permit issued under this subsection to require additional ambient monitoring to document possible adverse impacts on native aquatic vegetation or other aquatic life. If the department denies the application, the department shall provide to the applicant the scientific rationale for the denial, in writing.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Compiler's note: Former MCL 324.3304, which pertained to violation of part as misdemeanor and penalty, was repealed by Act 27 of 1996, Imd. Eff. Feb. 26, 1996.
Popular name: Act 451

324.3305 Registration of chemical used for aquatic nuisance control; evaluation; order to prohibit or suspend chemical use.

Sec. 3305. (1) A chemical shall not be used in waters of the state for aquatic nuisance control unless it is registered with the EPA, pursuant to section 3 of the federal insecticide, fungicide, and rodenticide act, 7 USC 136a, and the Michigan department of agriculture, pursuant to part 83, for the aquatic nuisance control activity for which it is used.
(2) The department may conduct evaluations of the impacts and effectiveness of any chemicals that are proposed for use for aquatic nuisance control in waters of the state. This may include the issuance of permits for field assessments of the chemicals.
(3) The director, in consultation with the director of the Michigan department of agriculture, may issue an order to prohibit or suspend the use of a chemical for aquatic nuisance control if, based on substantial scientific evidence, use of the chemical causes unacceptable negative impacts to human health or the environment. The department shall not issue permits authorizing the use of such chemicals. In addition, a person shall cease the use of such chemicals upon notification by the department.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Compiler's note: Former MCL 324.3305, which pertained to civil liability for unlawful acts against property lawfully set and used to take fish, was repealed by Act 27 of 1996, Imd. Eff. Feb. 26, 1996.
Popular name: Act 451

324.3306 Certificate of coverage; application fee.

Sec. 3306. (1) Until October 1, 2008, an application for a certificate of coverage under this part shall be accompanied by a fee of $75.00. Until October 1, 2008, subject to subsection (2), an application for an individual permit under this part shall be accompanied by the following fee, based on the size of the area of impact:

(a) Less than 1/2 acre, $75.00.
(b) One-half acre or more but less than 5 acres, $200.00.
(c) Five acres or more but less than 20 acres, $400.00.
(d) Twenty acres or more but less than 100 acres, $800.00.
(e) One hundred acres or more, $1,500.00.
(2) The department shall forward fees collected under this section to the state treasurer for deposit in the

land and water management permit fee fund created in section 30113.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3307 Approval or denial of application within certain time period.

Sec. 3307. (1) The department shall either approve or deny an application for a certificate of coverage by May 1 or within 15 working days after receipt of a complete application, whichever is later. If the department denies an application for a certificate of coverage, the department shall notify the applicant, in writing, of the reasons for the denial.
(2) The department shall approve an application for a permit in whole or part and issue the permit, or shall deny the application, by May 1 or within 30 working days after receipt of a complete application, whichever is later. If the department approves the application in part or denies the application, the department shall, by the same deadline, notify the applicant, in writing, of the reasons for the partial approval or denial.
(3) If the department fails to satisfy the requirements of subsection (1) or (2) with respect to an application for a certificate of coverage or a permit, the department shall pay the applicant an amount equal to 15% of the application fee for that certificate of coverage or permit.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3308 Written permission from bottomland owner.

Sec. 3308. An applicant shall obtain authorization to chemically treat the proposed area of impact by obtaining written permission from each person who owns bottomlands in the area of impact. The applicant shall maintain the written permission for 1 year from the expiration date of the permit and shall make the records available to the department upon request. Written permission from each bottomland owner is not required if the applicant is providing, or has contracted to provide, chemical treatment for either of the following:
(a) A lake board established under part 309 for the waterbody for which chemical treatment is proposed.
(b) This state or a local unit of government acting under authority of state law to conduct lake improvement projects or to control aquatic vegetation.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3309 Information included in permit; additional conditions.

Sec. 3309. (1) A permit under this part shall, at a minimum, include all of the following information:
(a) The active ingredient or the trade name of each chemical to be applied.
(b) The application rate of each chemical.
(c) The maximum amount of each chemical to be applied per treatment.
(d) Minimum length of time between treatments for each chemical.
(e) A map or maps that clearly delineate the approved area of impact.
(2) The department may impose additional conditions on a permit under this part to protect the natural resources or the public health, to prevent economic loss or impairment of recreational uses, to protect nontarget organisms, or to help ensure control of the aquatic nuisance.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3310 Permit conditions.

Sec. 3310. As a condition of a permit under this part, the department may require the permittee to do any of the following:
(a) Notify the department not less than 2 working days in advance of chemical treatment.
(b) Proceed with chemical treatment only if a department representative is present.

(c) Allow the department or its representative to collect a sample of the chemical or chemicals used before or during any chemical treatment.
(d) Post the area of impact before chemical treatment with signs, as follows:
(*i*) Each sign shall be of a brilliant color and made of sturdy, weather-resistant material. Each sign shall be at least 8-1/2 by 11 inches and shall be attached to a supporting device with the bottom of the sign at least 12 inches above the ground surface.
(*ii*) Signs shall be posted in the following locations:
(A) Subject to sub-subparagraph (C), along the shoreline of the area of impact not more than 100 feet apart. Signs shall also be posted in riparian lands adjacent to that portion of the shoreline.
(B) Subject to sub-subparagraph (C), for an area of impact of 2 or more acres, at all access sites, boat launching areas, and private and public parks located on the waterbody in conspicuous locations, such as at the entrances, boat ramps, and bulletin boards, if permitted by managers or owners. If the access sites, launching areas, and parks are not to be treated or are not adjacent to the area of impact, then the signs shall

clearly indicate the location of the area of impact.
(C) At alternative posting locations approved by the department upon a determination that the locations where signs are otherwise required to be posted are impractical or unfeasible. The department's determination shall be based on a written request from the applicant that includes an explanation of the need for alternative posting locations and a description of the proposed alternative posting locations.
(*iii*) The department shall specify by rule the information required to be on the signs.
(e) Publish a notice in a local newspaper or make an announcement on a local radio station regarding the chemical treatment. The notice or announcement shall include all of the following information:
(*i*) The permit number.
(*ii*) The name of the waterbody.
(*iii*) A list of the chemicals to be used with corresponding water use restrictions.
(*iv*) A description of the area of impact.
(*v*) The proposed treatment dates.
(f) Apply chemicals so that swimming restrictions and fish consumption restrictions are not imposed on any Saturday, Sunday, or state-declared holiday.
(g) Take special precautions to avoid or minimize potential impacts to human health, the environment, and nontarget organisms.
(h) Notify, in writing, an owner of any waterfront property within 100 feet of the area of impact, not less than 7 days and not more than 45 days before the initial chemical treatment. However, if the owner is not the occupant of the waterfront property or the dwelling located on the property, then the owner is responsible for notifying the occupant. Written notification shall include all of the following information:
(*i*) Name, address, and telephone number of the permittee.
(*ii*) A list of chemicals proposed for use with corresponding water use restrictions.
(*iii*) Approximate treatment dates for each chemical to be used.
(i) Complete and return the treatment report form provided by the department for each treatment season.
(j) Perform lake water residue analysis to verify the chemical concentrations in the waterbody according to a frequency, timing, and methodology approved by the department.
(k) Before submitting a permit application, perform aquatic vegetation surveys according to a frequency, timing, and methodology approved by the department.
(*l*) Use chemical control methods for nuisance aquatic vegetation that are consistent with the approved vegetation management plan submitted separately or as part of a lake management plan. The department may approve modifications to the vegetation management plan upon receipt of a written request from the permittee that includes supporting documentation.
(m) Perform pretreatment monitoring of the target aquatic nuisance population according to a frequency, timing, and methodology that has been approved by the department before submittal of a permit application.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3311 Permit revisions.

Sec. 3311. The department may make minor revisions to a permit under this part, to minimize the impacts to the natural resources, public health, and safety, or to improve aquatic nuisance control, if the proposed revisions do not involve a change in the scope of the project, and the permittee requests the revisions in writing. The request shall include all of the following information:
(a) The proposed changes to the permit.

(b) An explanation of the necessity for the proposed changes.
(c) Maps that clearly delineate any proposed changes to the area of impact.
(d) Additional information that would help the department reach a decision on a permit amendment.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3312 Rules.

Sec. 3312. The department may promulgate rules to implement this part.
History: Add. 2004, Act 246, Eff. Oct. 1, 2004.
Popular name: Act 451

324.3313 Violations as misdemeanors; penalty; commencement of civil action by attorney general; revocation of permit or certificate of coverage.

Sec. 3313. (1) A person who commits a violation of this part that does not result in harm to or pose a substantial threat to natural resources, the environment, or human health is guilty of a misdemeanor punishable by a fine of not more than $500.00 for each violation. A law enforcement officer may issue and serve an appearance ticket upon a person for that violation pursuant to sections 9a to 9g of chapter IV of the code of criminal procedure, 1927 PA 175, MCL 764.9a to 764.9g.

(2) A person who commits a violation of this part that results in harm to or poses a substantial threat to natural resources, the environment, or human health, or a corporate officer who had advance knowledge of such a violation of this part but failed to prevent the violation, is guilty of a misdemeanor and may be imprisoned for not more than 6 months and shall be fined not less than $1,000.00 or more than $2,500.00.
(3) A person who commits a violation described in subsection (2) after a first conviction for such a violation is guilty of a misdemeanor and may be imprisoned for not more than 1 year and shall be fined not less than $2,500.00 or more than $5,000.00.
(4) A person who commits a violation of this part that results in serious harm to or poses an imminent and substantial threat to natural resources, the environment, or human health and who knew or should have known that the violation could have such a result is guilty of a misdemeanor and may be imprisoned for not more than 1 year and shall be fined not less than $5,000.00 or more than $10,000.00.
(5) A person who commits a violation described in subsection (4) after a first conviction for such a violation is guilty of a misdemeanor and may be imprisoned for not more than 2 years and shall be fined not less than $7,500.00 or more than $15,000.00.
(6) A person who knowingly makes a false statement, representation, or certification in an application for a permit or a certificate of coverage or in a report required by a permit or certificate of coverage issued under or rule promulgated under this part is guilty of a misdemeanor and shall be fined not less than $1,000.00 or more than $2,500.00.
(7) A person who commits a violation described in subsection (6) after a first conviction for such a violation is guilty of a misdemeanor and may be imprisoned for not more than 1 year and shall be fined not less than $2,000.00 or more than $5,000.00.
(8) The attorney general may commence a civil action for appropriate relief for a violation of this part, including a permanent or temporary injunction restraining a violation or ordering restoration of natural resources affected by a violation and a civil fine of not more than $25,000.00. The action may be commenced in the circuit court for the county of Ingham or the county in which the violation occurred.
(9) If a person knowingly commits a violation of this part, the department may revoke a permit or certificate of coverage issued to the person under this part.

History: Add. 2004, Act 247, Eff. Oct. 1, 2004.

Rendered Friday, February 02, 2007 Page 5 Michigan Compiled Laws Complete Through PA 461, 463-517, 519-571, 573, 575-583, 585-588, 590-593, 595-601, 603-629, 632-656, 658-671, 675-679, 681, and 682 of 2006

16.8 Species Distribution Maps

* Rake scores are included for each sample site where the species was collected

Figure 5: 2006 Leafy Pondweed Sites

Figure 6: 2006 Bladderwort Sites

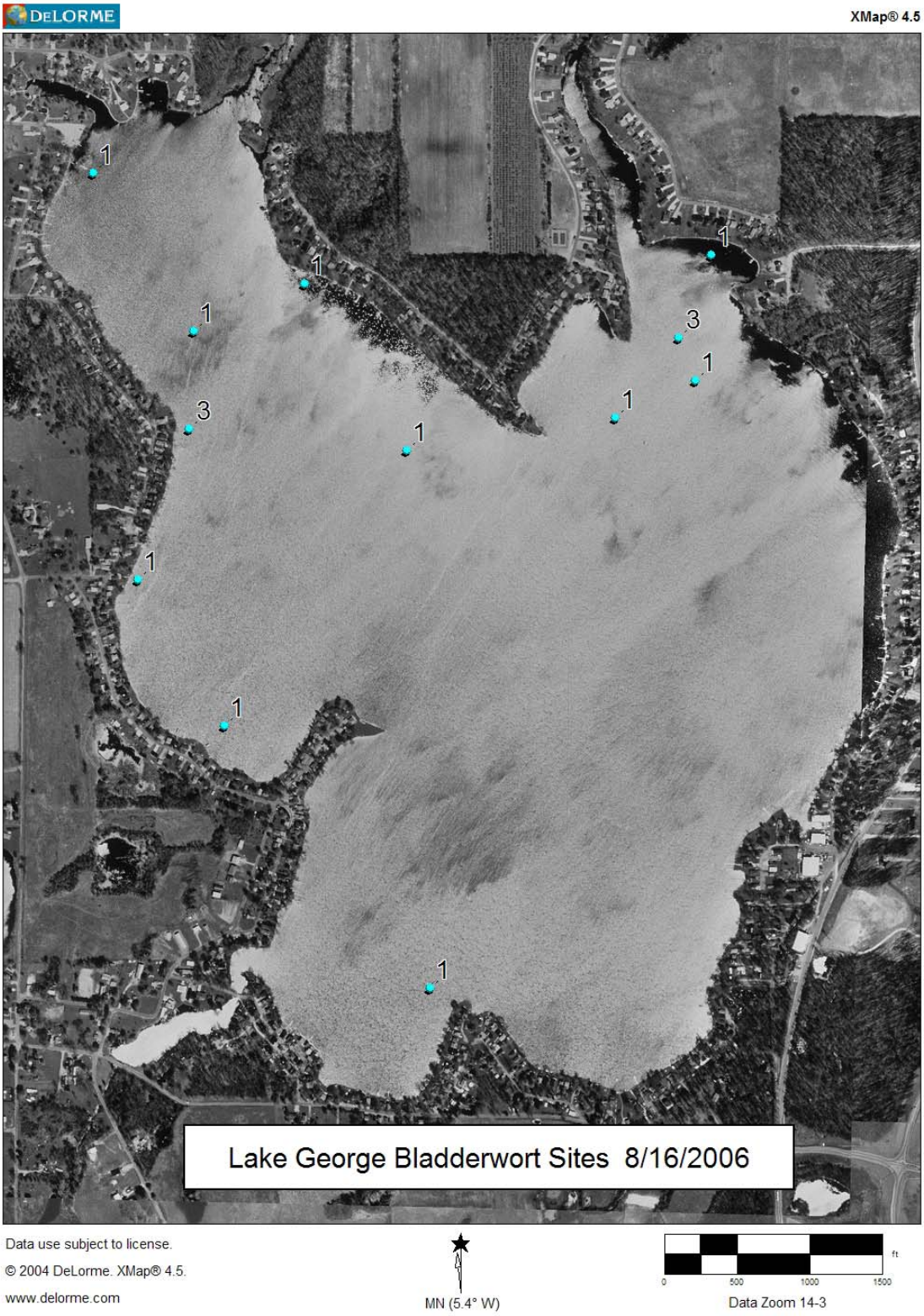


Figure 7: 2006 Brittle Naiad Sites

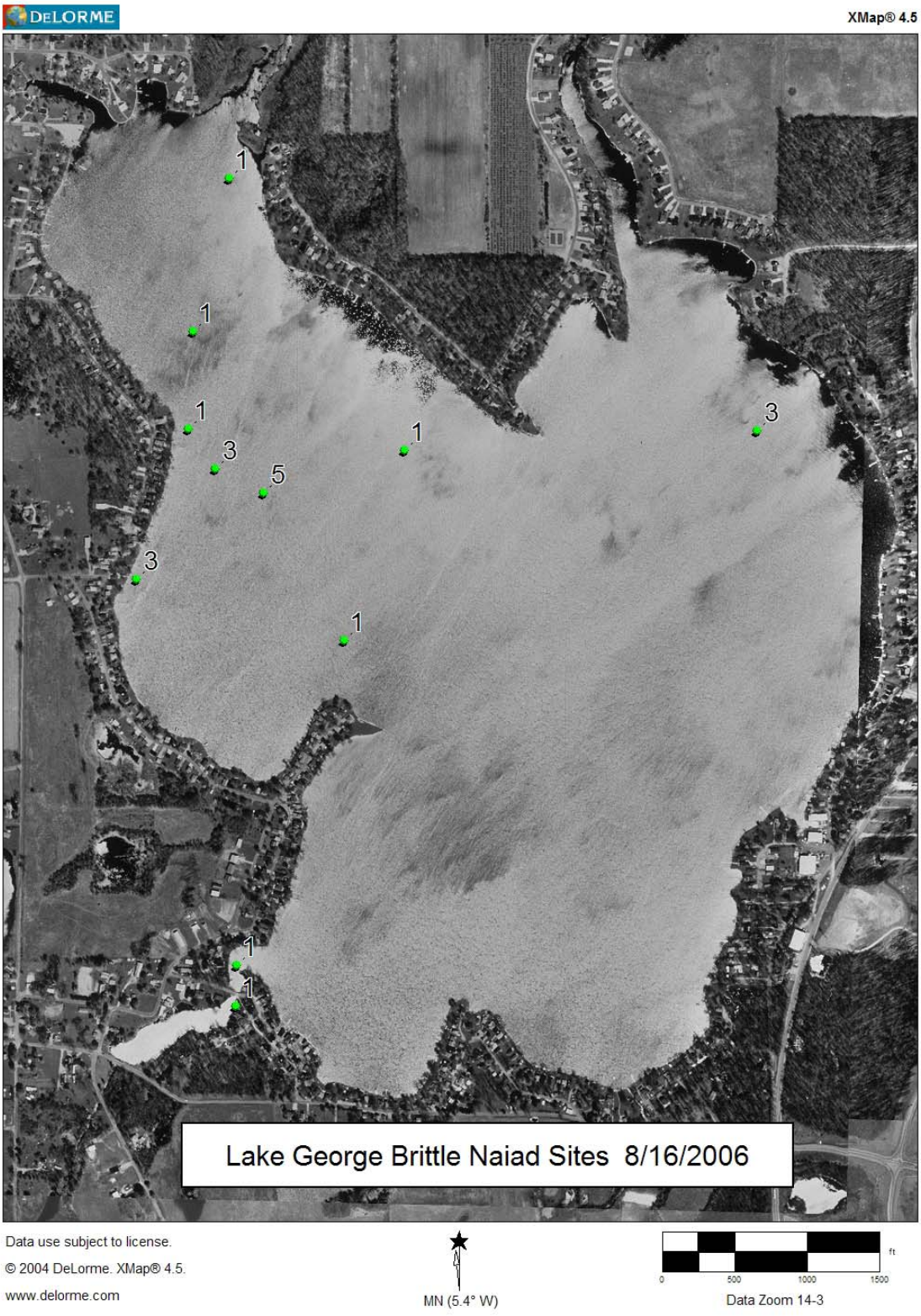


Figure 8: 2006 Chara Sites

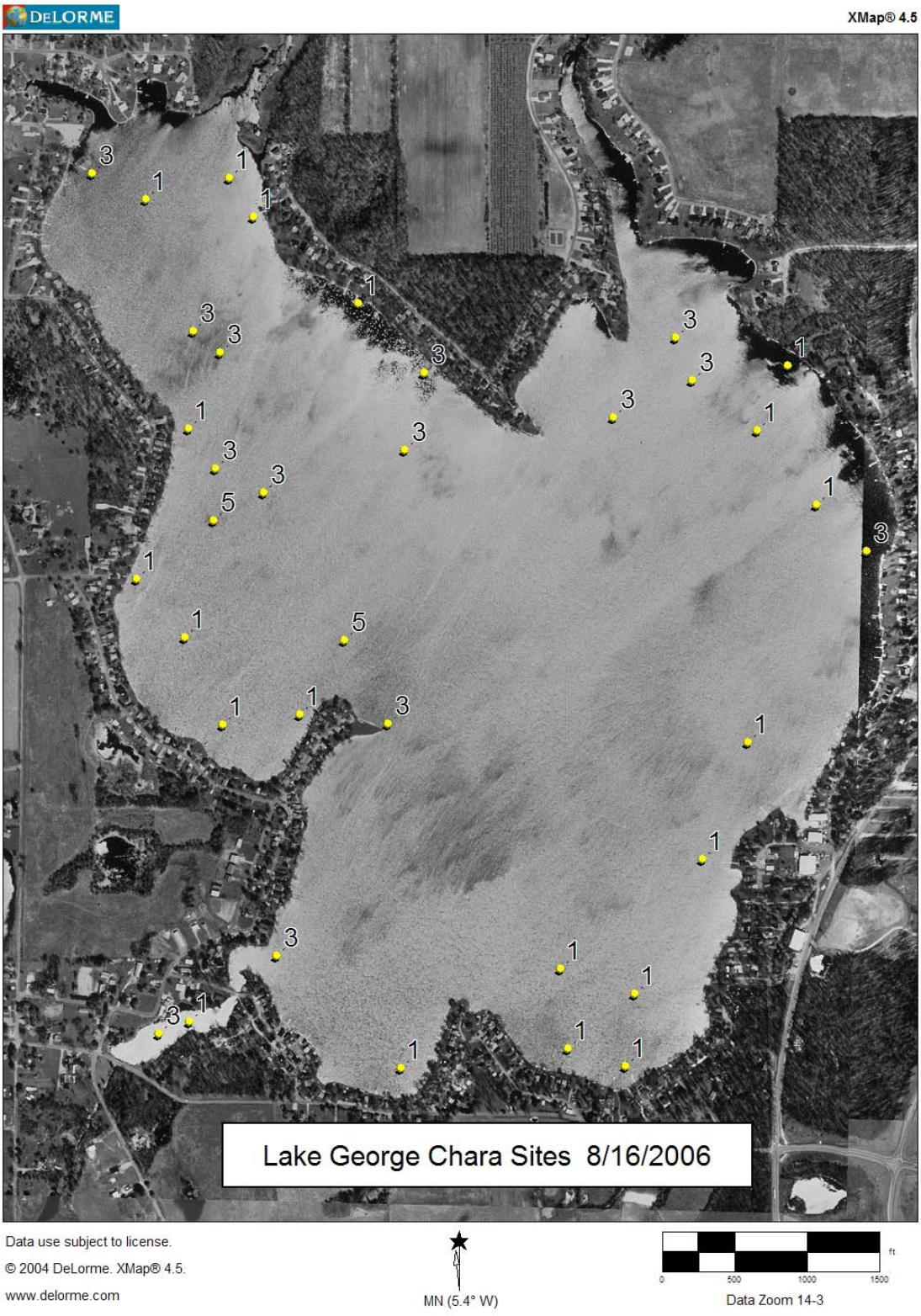


Figure 9: 2006 Coontail Sites

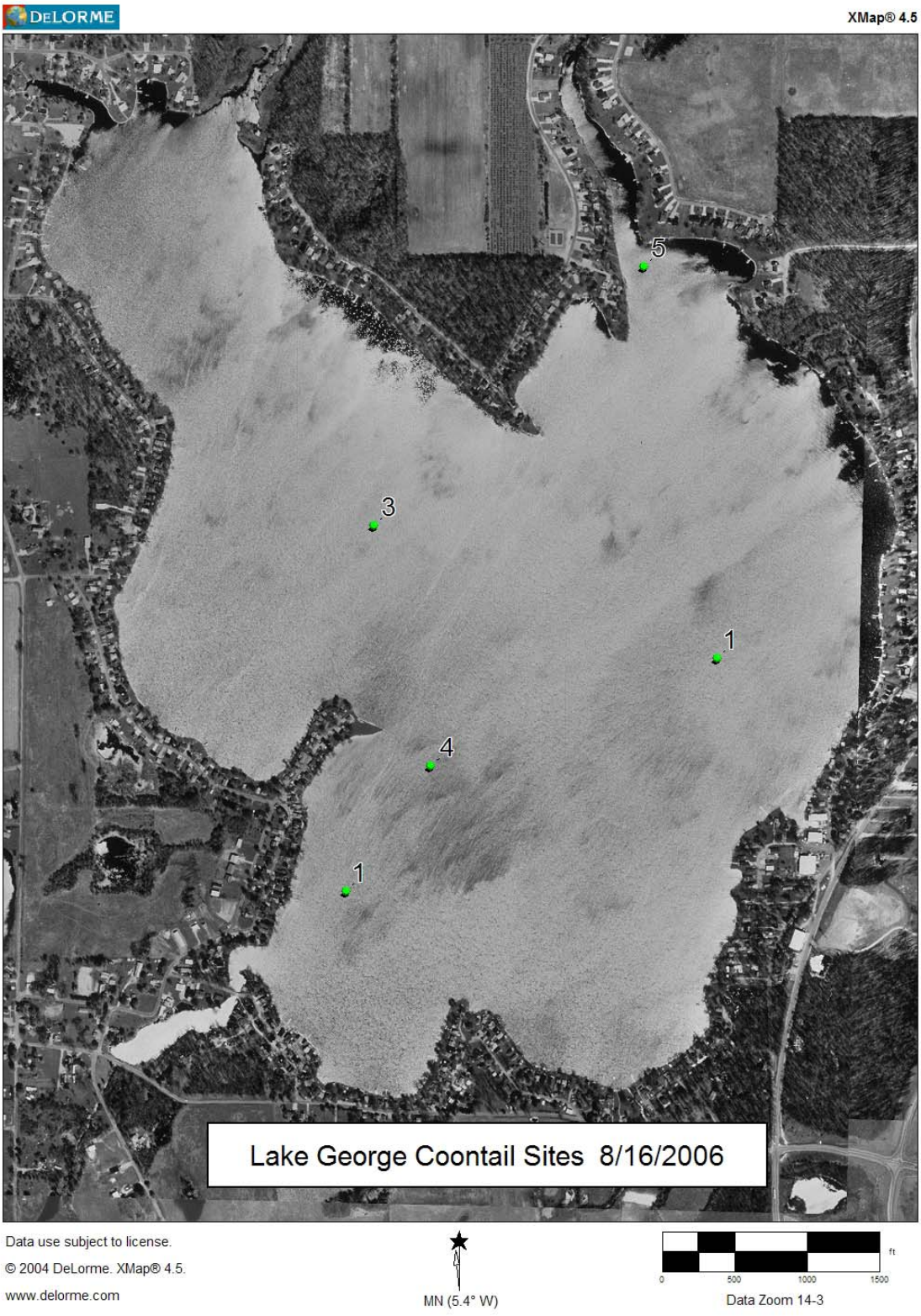


Figure 10: 2006 Eelgrass Sites

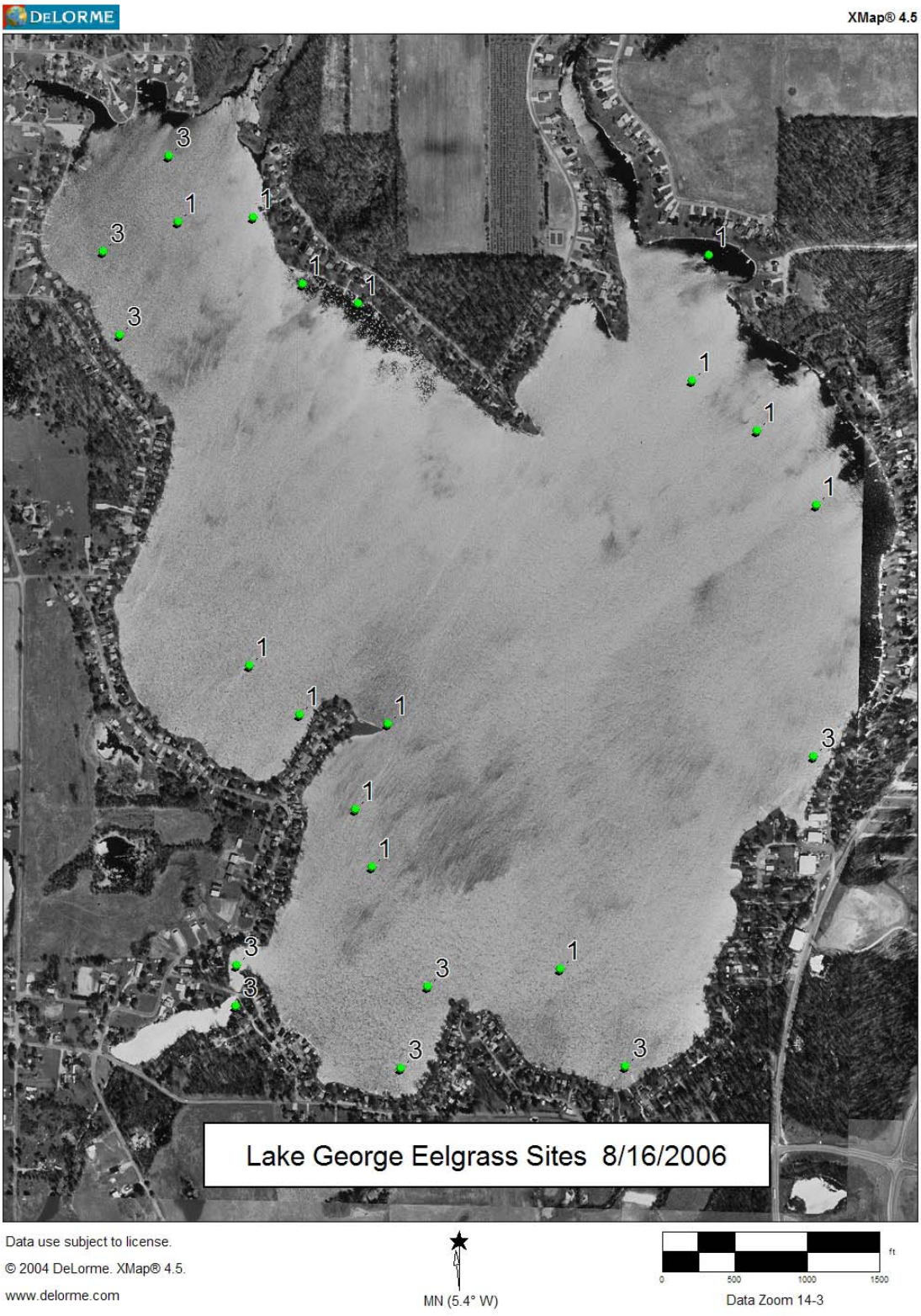


Figure 11: 2006 Elodea Sites

Figure 12: 2006 Eurasian Watermilfoil Sites

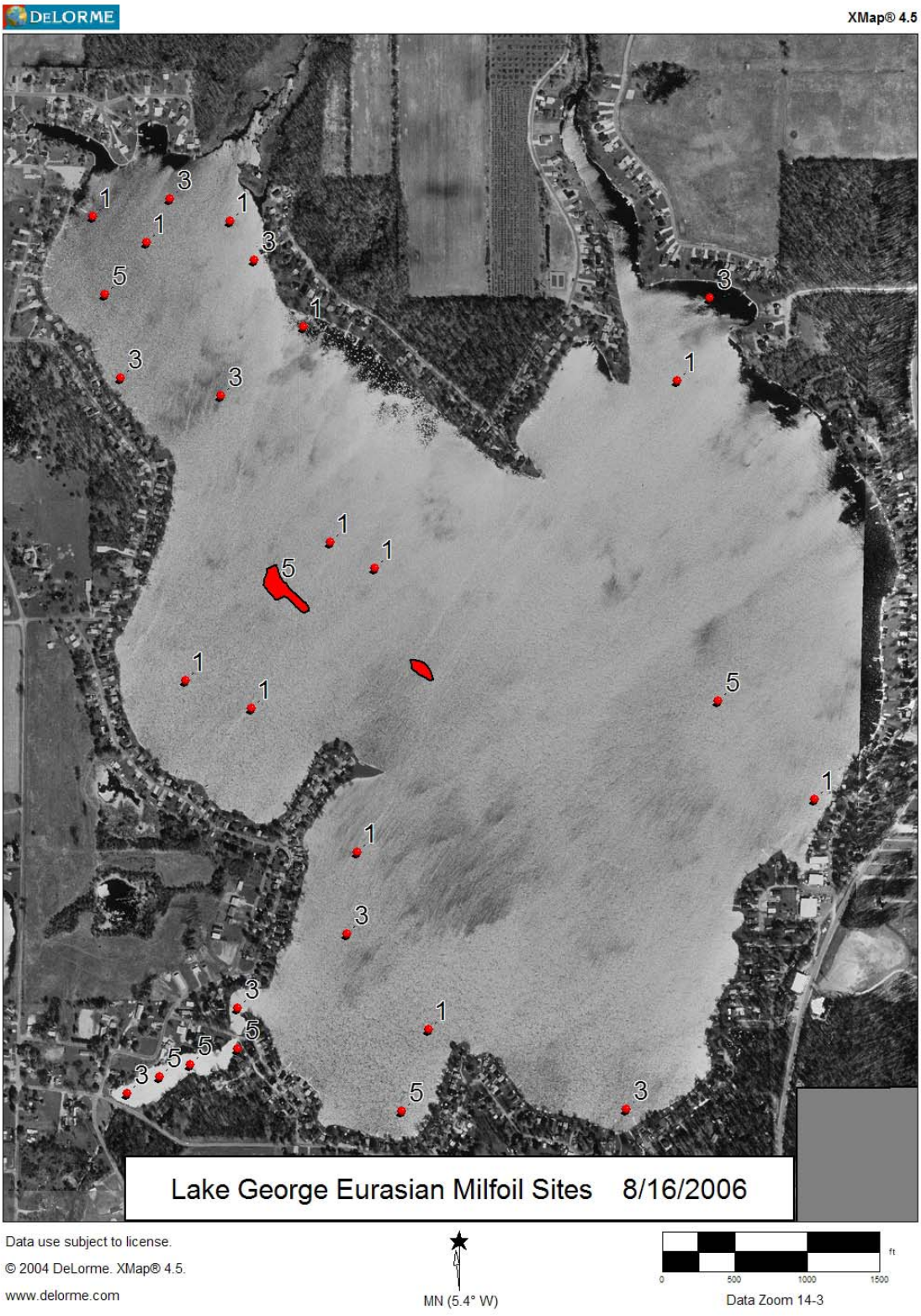


Figure 13: 2006 Flat-stemmed Pondweed Sites

Figure 14: 2006 Illinois Pondweed Sites

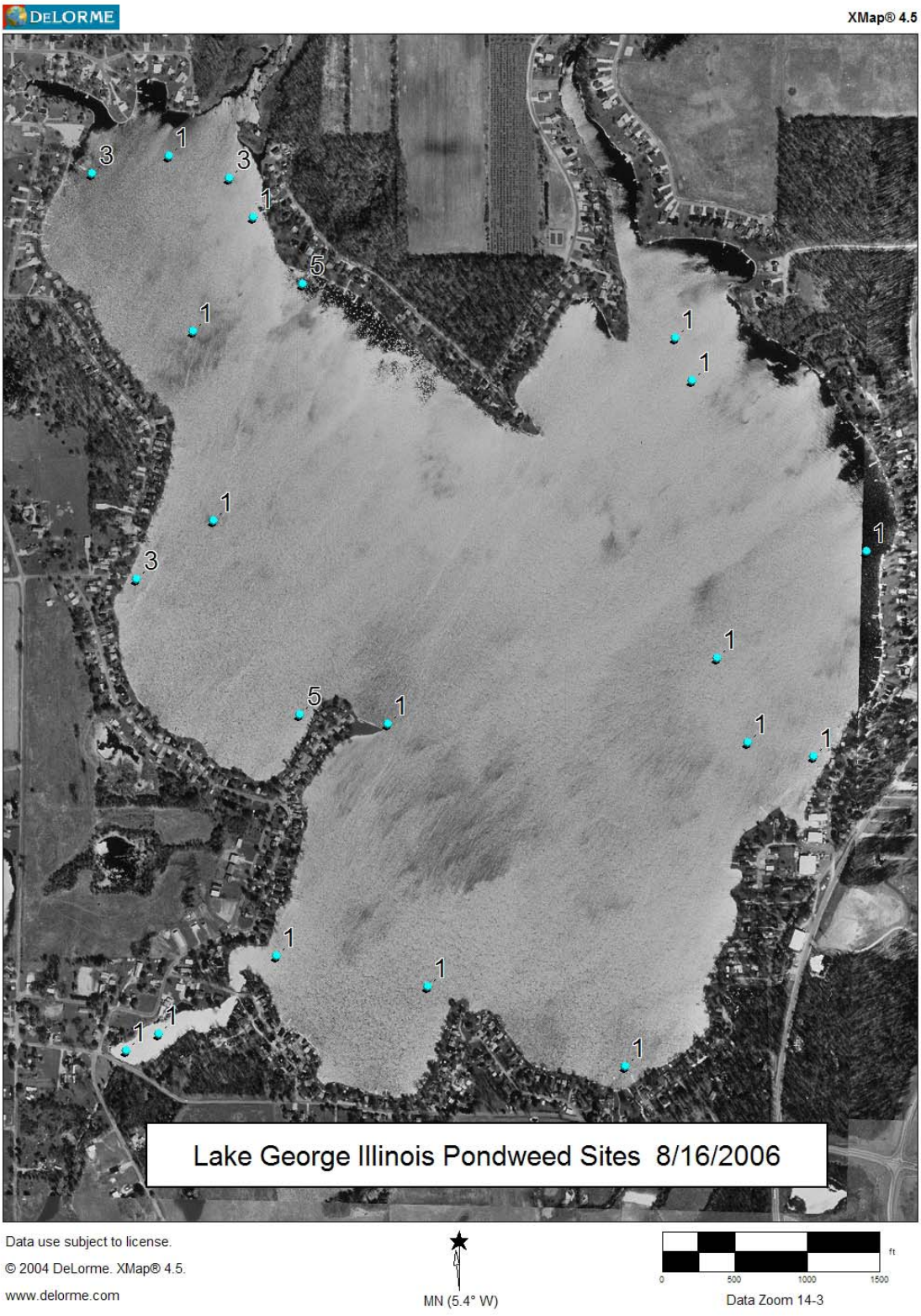


Figure 15: 2006 Largeleaf Pondweed Sites

Figure 16: 2006 Nitella Sites

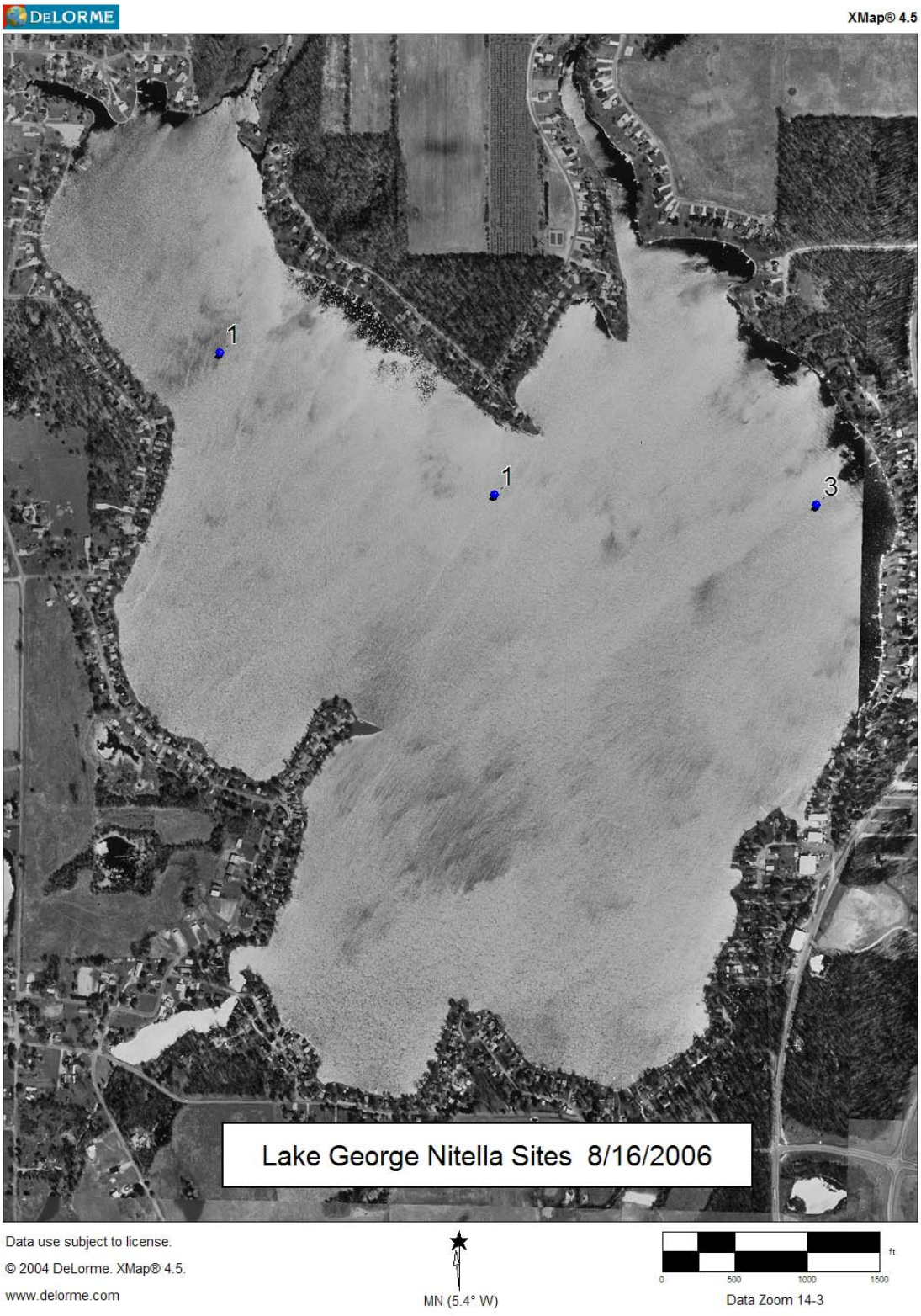


Figure 17: 2006 Northern Watermilfoil Sites

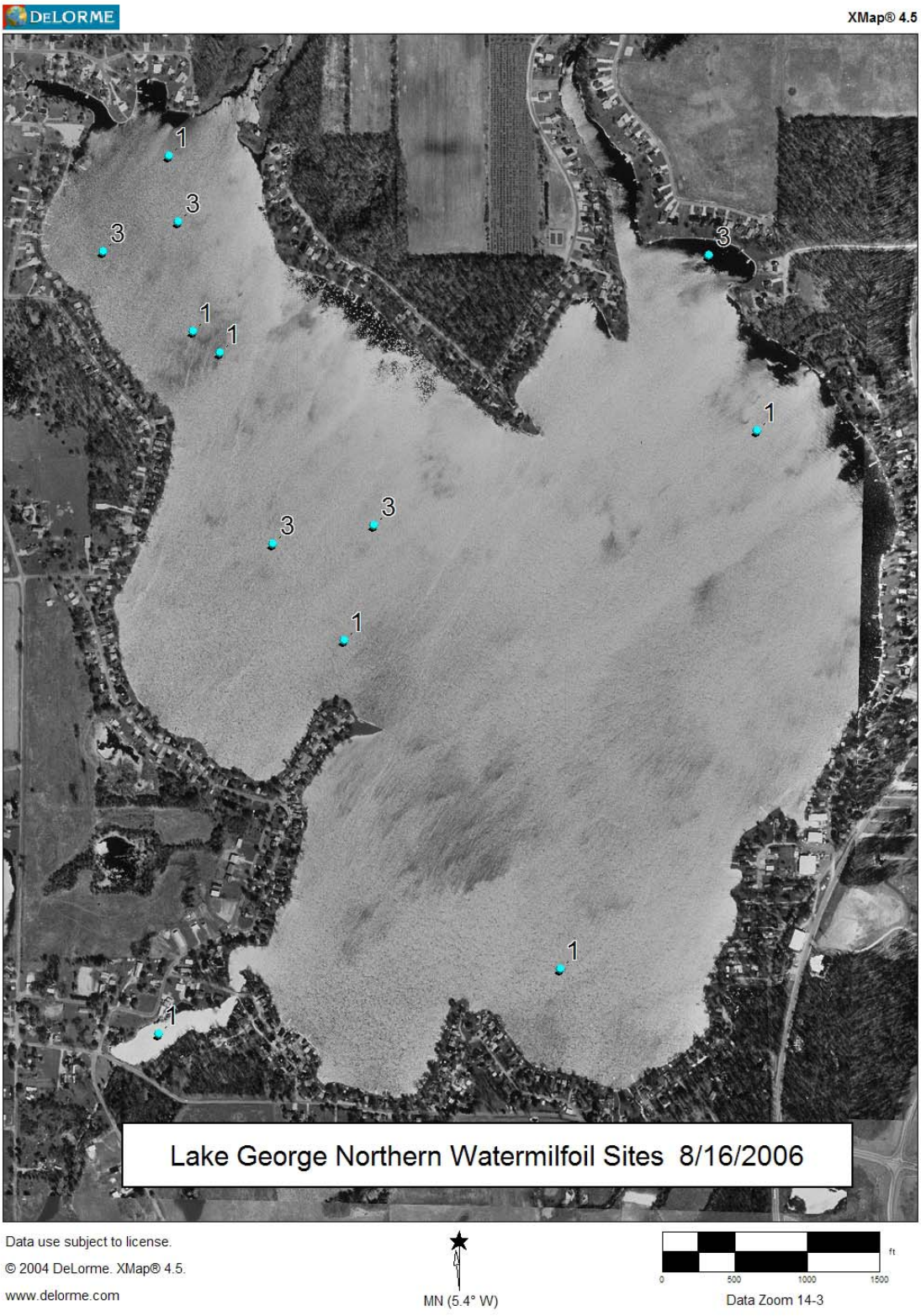


Figure 18: 2006 Richardson's Pondweed Sites

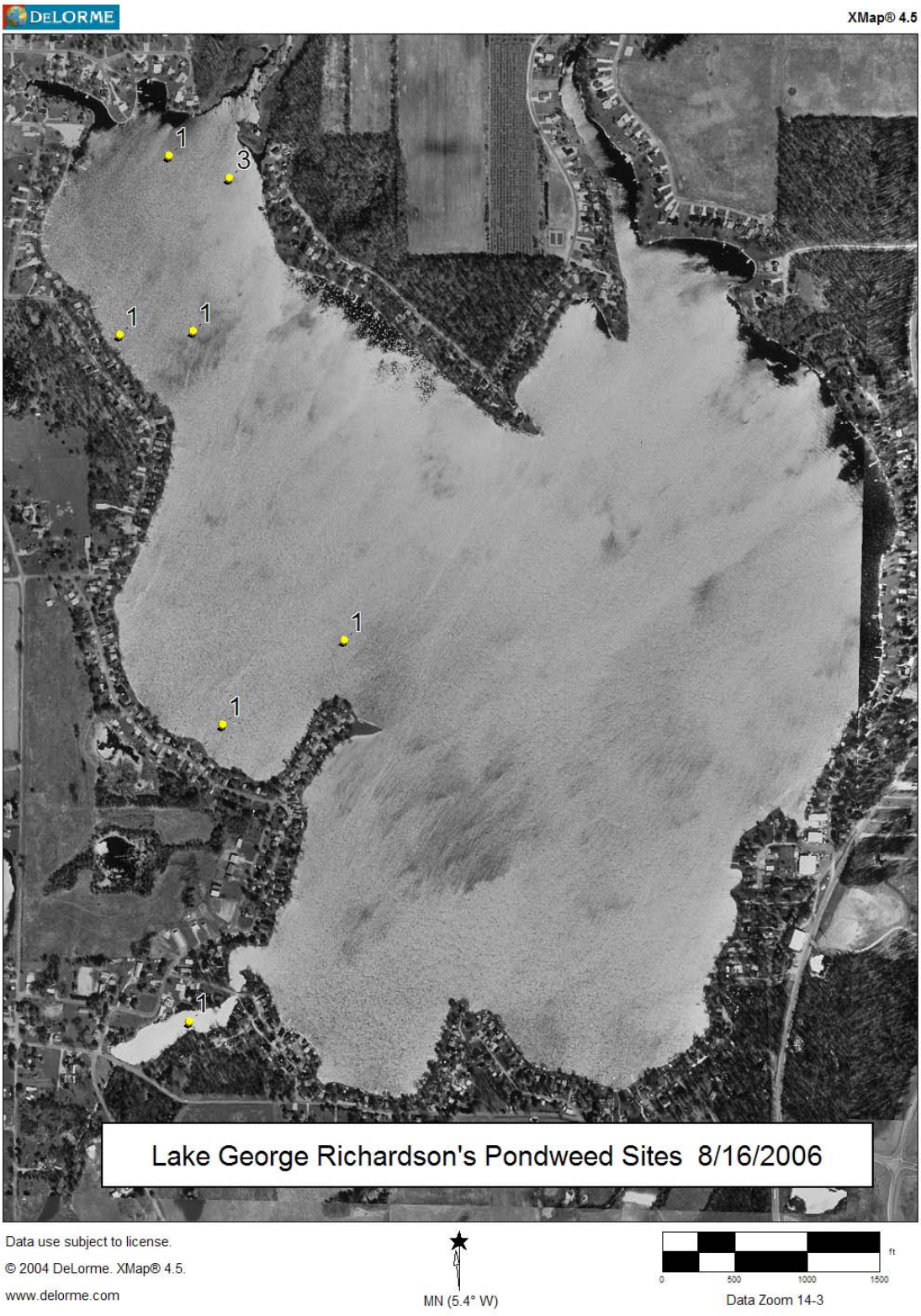


Figure 19: 2006 Sago Pondweed Sites

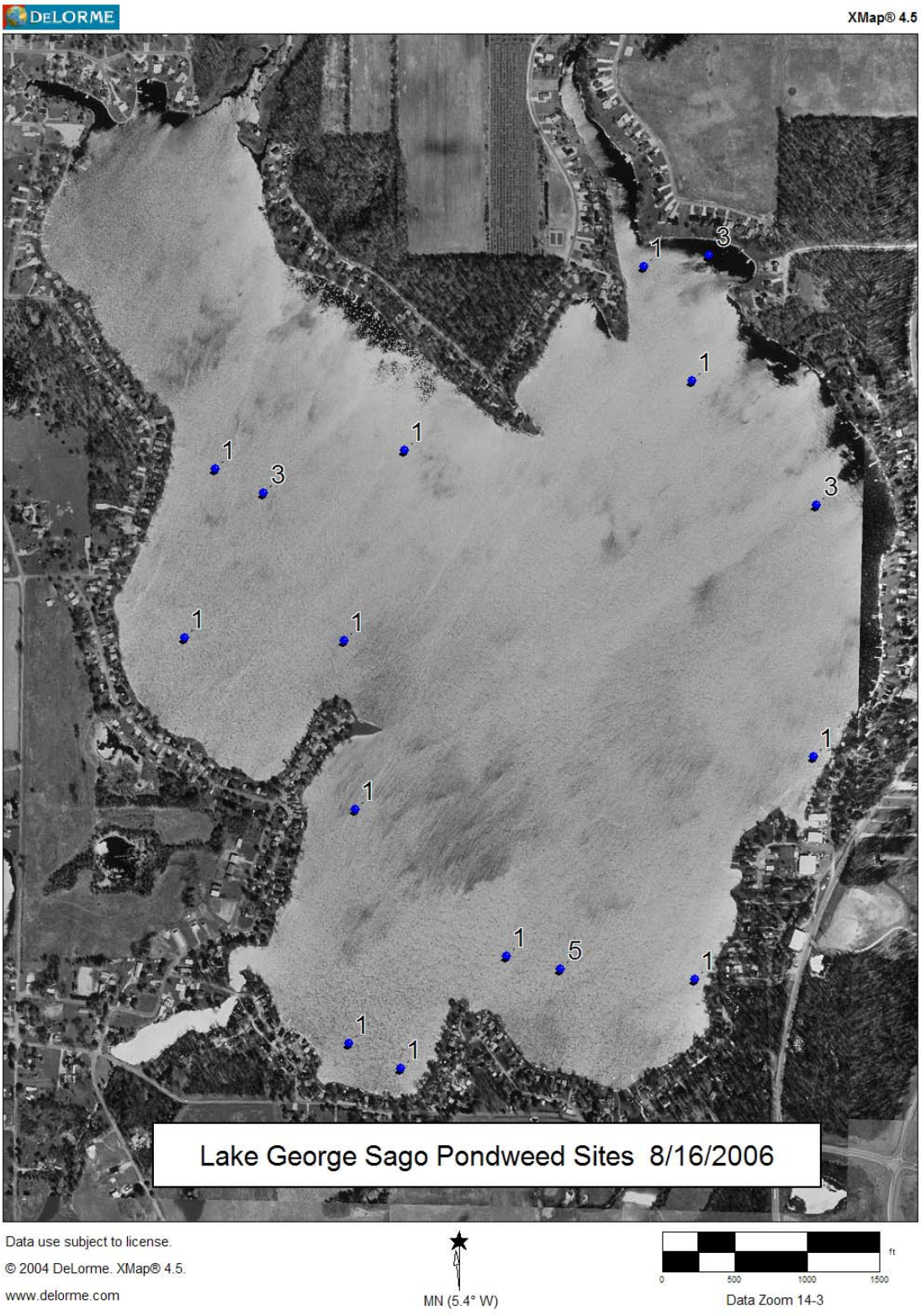


Figure 20: 2006 Slender Naiad Sites

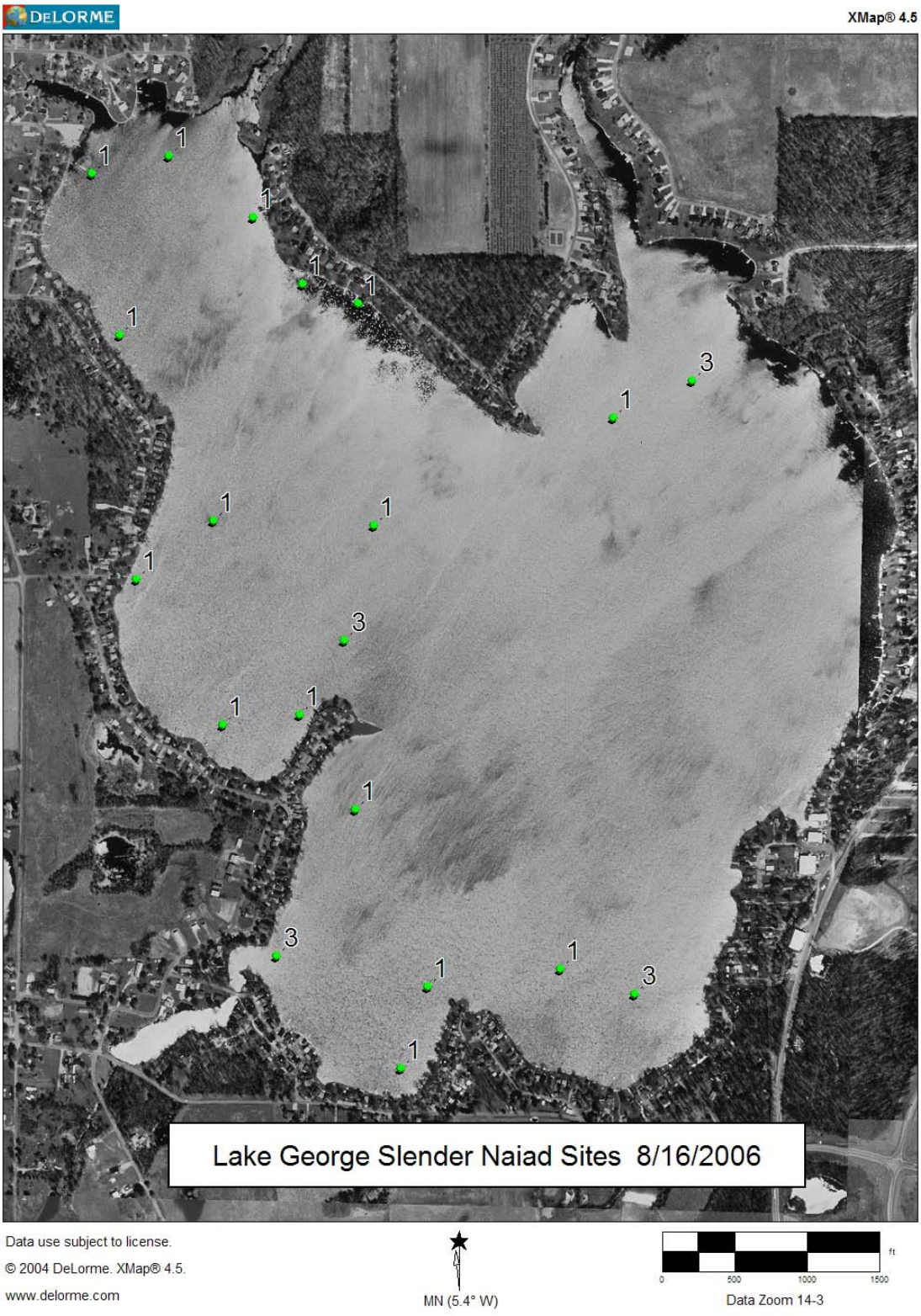
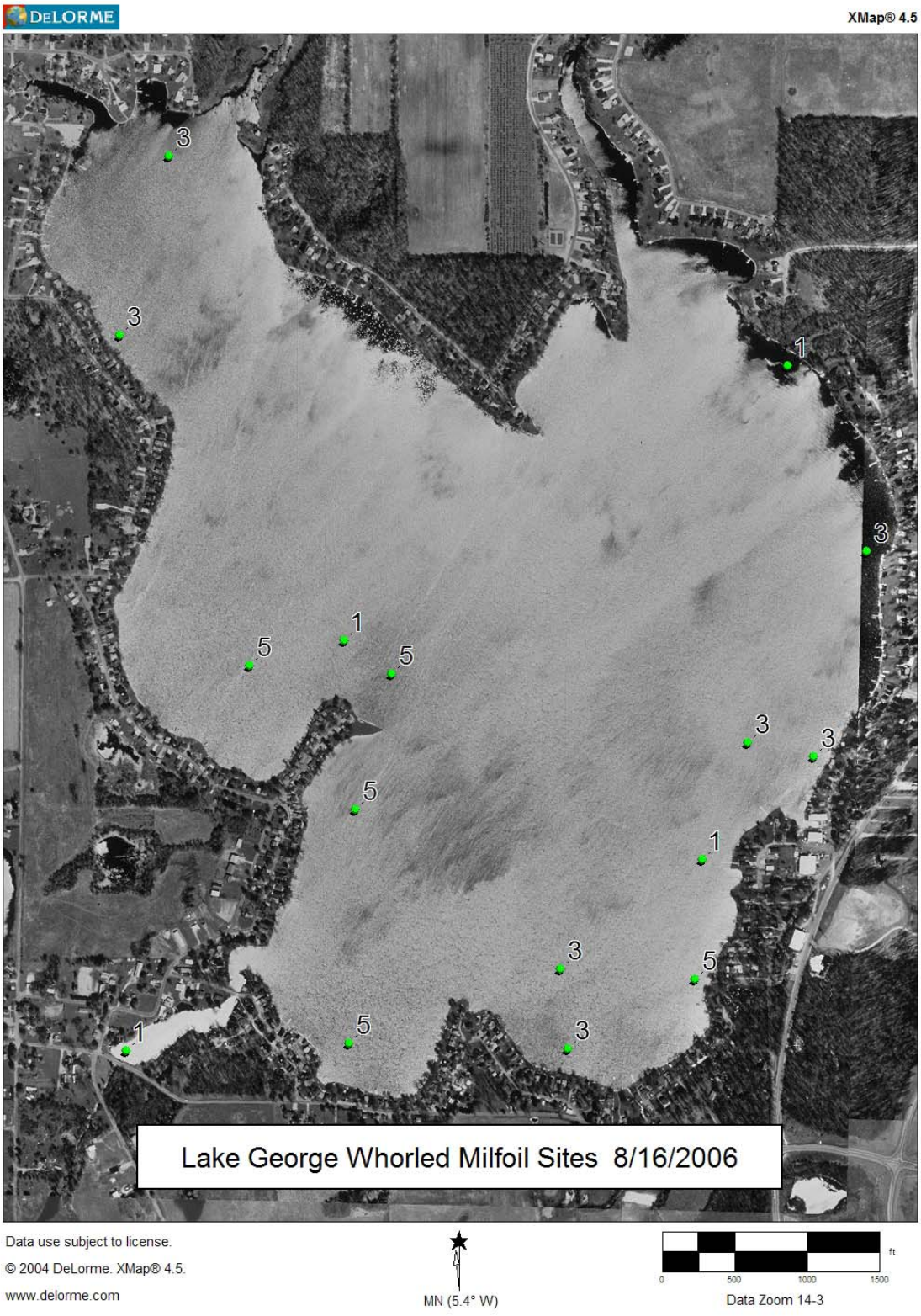


Figure 21: 2006 Waterstargrass Sites

Figure 22: 2006 Whorled Watermilfoil Sites



16.9 Data Sheets

Table 19: 2006 Tier II Data Sheet #1

APPENDIX A

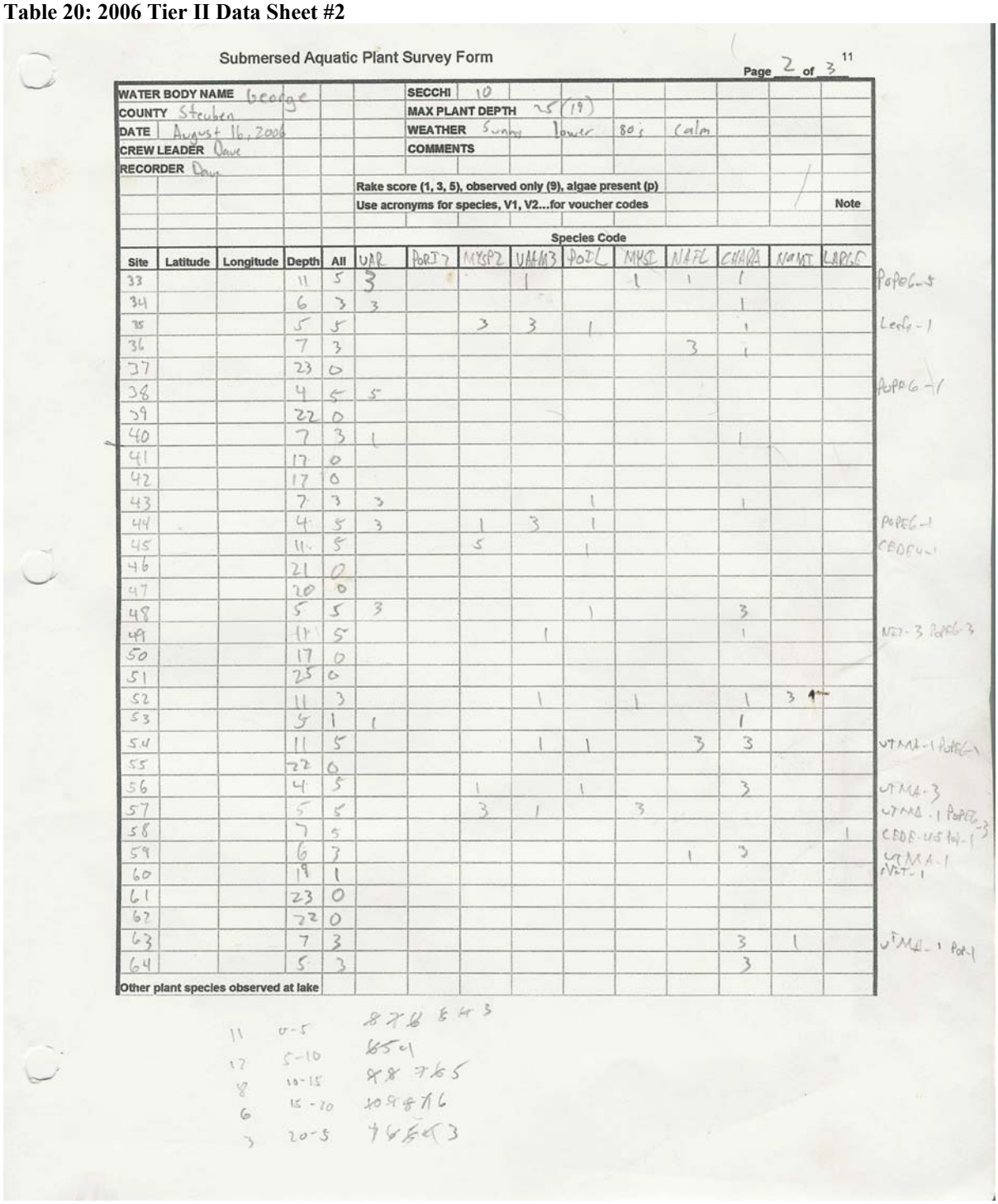
Submersed Aquatic Plant Survey Form

Page 1 of 3 11

WATER BODY NAME	Lake George				SECCHI	10								
COUNTY	Steuben IN/ Branch MI				MAX PLANT DEPTH	25 (19)								
DATE	August 16, 2006				WEATHER	Sunny, Lower 80's Calm								
CREW LEADER	Dave				COMMENTS	0-5	5-10	10-15	15-20	20-25				
RECORDER	Dave				488 ac	Olig	19	18	17	16	10			80-101
					Rake score (1, 3, 5), observed only (9), algae present (p)									
					Use acronyms for species, V1, V2...for voucher codes									Note
					Species Code									
Site	Latitude	Longitude	Depth	All	VAR	POFI2	MYSP2	VAAM2	POFI	MYSI	NAFL	CHAR	VAMI	LARGE
1			4	5	3	1	3	3	1	1	1			
2			5	3			1					1		
3			3	5			1		3		1	3		1
4			9	5			5	3		3				
5			3	5	3	1	3	3			1			1
6			7	5		1			1	1		3	1	
7			14	5			3			1		3		
8			5	3								1	1	
9			6	5								3	3	
10			10	5								3	5	
11			15	1			1							
12			6	5			5			3				
13			5	5					1		1	5		
14			4	5					3		1	1	3	
15			12	3			1					1		
16			16	5	5		1	1						
17			6	3		1					1	1		
18			4	5				1	5		1	1		
19			6	5	1	1				1	3	5	1	
20			19	0										
21			24	0										
22			13	5	5									
23			2	3				1	1			3		
24			16	1										
25			12	5	5		1	1			1			
26			7	3			3							
27			3	5					1		3	3		
28			12	0										
29			16	5	5									
30			6	5			5	3			1	1		
31			11	3			1	3	1		1			
32			16	1										
Other plant species observed at lake														

UTAU-1
UTAU-1
NIT-1
UTAU-3
POPEG-1
POPEG-3
UTAU-1
POPEG-1 NIT-1
UTAU-1
POPEG-1
CEDE-1
POPEG-1
CEDE-1
LEMI-1
POPEG-1
POPEG-1 NIT-1
UTAU-1
POPEG-1

Table 20: 2006 Tier II Data Sheet #2



Submersed Aquatic Plant Survey Form

Page 2 of 3 11

WATER BODY NAME	George	SECCHI	10	
COUNTY	Steuben	MAX PLANT DEPTH	25 (19)	
DATE	August 16, 2006	WEATHER	Sunny lower 80's Calm	
CREW LEADER	Dave	COMMENTS		
RECORDER	Dave			

Rake score (1, 3, 5), observed only (9), algae present (p)

Use acronyms for species, V1, V2...for voucher codes — Note

Site	Latitude	Longitude	Depth	All	Species Code: VAR	POR2	MYSP2	VAAM3	POZL	MYSI	NAFL	CHARA	NIMT	LARGE
33			11	5	3			1		1	1	1		
34			6	3	3							1		
35			5	5			3	3	1			1		
36			7	3							3	1		
37			23	0										
38			4	5	5									
39			22	0										
40			7	3	1							1		
41			17	0										
42			17	0										
43			7	3	3				1			1		
44			4	5	3		1	3	1					
45			11	5			5		1					
46			21	0										
47			20	0										
48			5	5	3				1			3		
49			11	5				1				1		
50			17	0										
51			25	0										
52			11	3				1		1		1	3	
53			5	1	1							1		
54			11	5				1	1		3	3		
55			22	0										
56			4	5			1		1			3		
57			5	5			3	1		3				
58			7	5										1
59			6	3							1	2		
60			19	1										
61			23	0										
62			22	0										
63			7	3								3	1	
64			5	3								3		
Other plant species observed at lake														

PoPeG-5

LeeG-1

PoPeG-1

PoPeG-1

CEDEG-1

NIT-3 PoPeG-3

UTMA-1 PoPeG-1

UTMA-3

UTMA-1 PoPeG-3

CEDE-US tol-1

UTMA-1

NAT-1

UTMA-1 Por-1

11 0-5

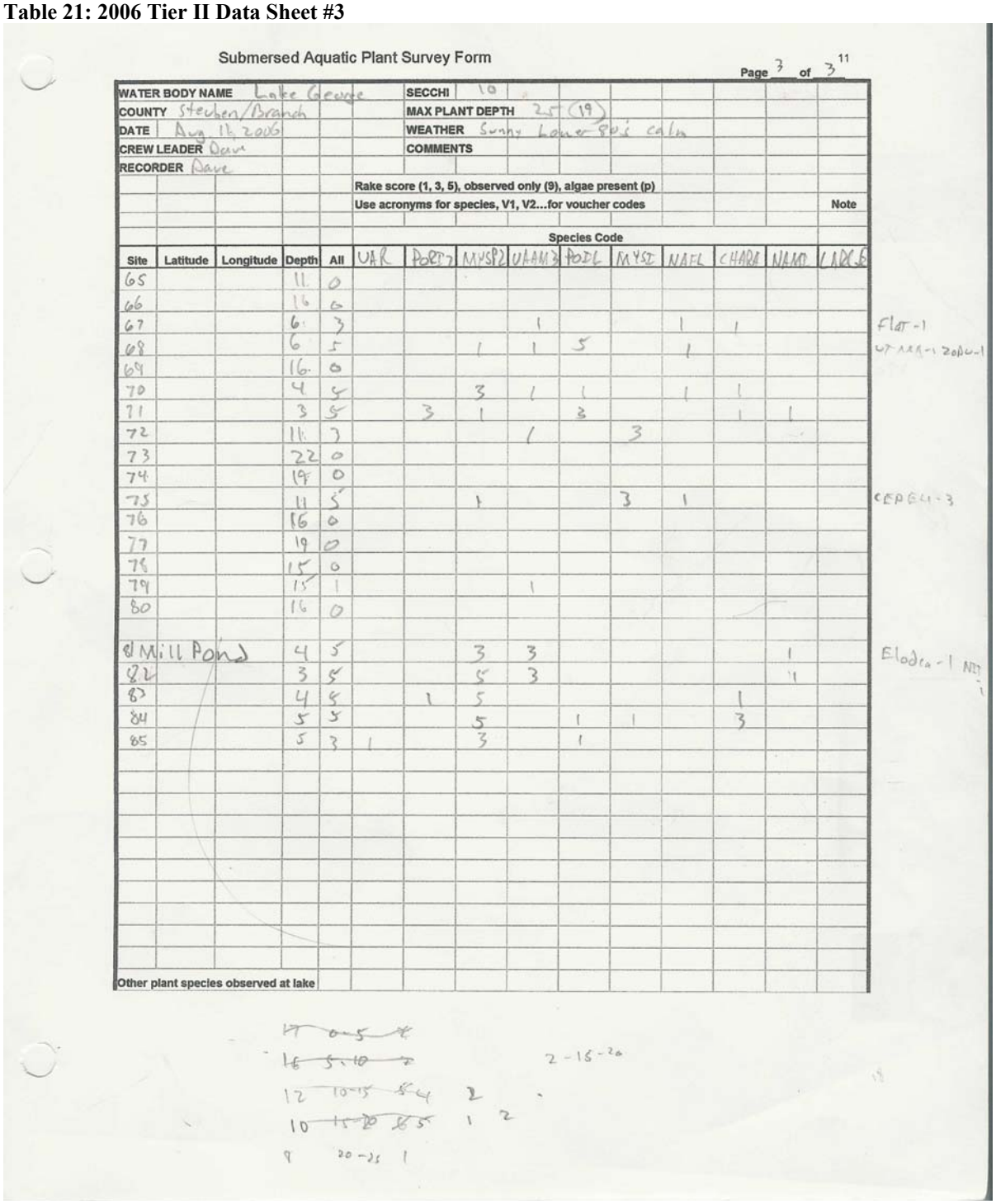
17 5-10

8 10-15

6 15-20

3 20-5

Table 21: 2006 Tier II Data Sheet #3



Submersed Aquatic Plant Survey Form

Page 3 of 3 11

WATER BODY NAME	Lake George				SECCHI	10										
COUNTY	Steuben/Branch				MAX PLANT DEPTH	25 (19)										
DATE	Aug 16, 2006				WEATHER	Sunny Lower 80's calm										
CREW LEADER	Dave				COMMENTS											
RECORDER	Dave															
					Rake score (1, 3, 5), observed only (9), algae present (p)											
					Use acronyms for species, V1, V2...for voucher codes											Note
					Species Code											
Site	Latitude	Longitude	Depth	All	VAR	POEN	MYSP2	UTAM3	POIL	MYSI	NAFL	CHARA	NAMI	LARGE		
65			11	0												
66			16	0												
67			6	3				1			1	1			Flat-1	
68			6	5			1	1	5		1				UTAM-1 ZODU-1	
69			16	0												
70			4	5			3	1	1		1	1				
71			3	5		3	1		3			1	1			
72			11	3				1		3						
73			22	0												
74			19	0												
75			11	5			1			3	1				CERDEM-3	
76			16	0												
77			19	0												
78			15	0												
79			15	1				1								
80			16	0												
81 Mill Pond			4	5			3	3					1		Elodea-1 NEI	
82			3	5			5	3					1			
83			4	5		1	5					1				
84			5	5			5		1	1		3				
85			5	3	1		3		1							
Other plant species observed at lake																

~~17 0-5 ~~

~~15 5-10 ~~ 2-15-20

12 ~~10-15 5~~ 4 2

~~10 15 20 25~~ 5 1 2

9 20-25 1

Aquatic Vegetation Plant Bed Data Sheet

Page 1 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: S1

Bed Size: 81 ac

Substrate: 3

Marl? 1

High Organic? 0

Waterbody Name: George

Waterbody ID:

Total # of Species: 7

Canopy Abundance at Site

S: 4 N: — F: 1 E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 45.018 Rings Lake

Longitude: W85 01.178

Max. Lakeward Extent of Bed

Latitude: N41 45.451

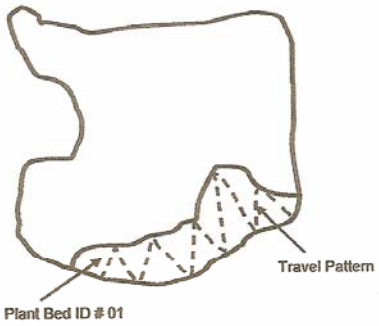
Longitude: W85 01.712

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	3			
MYRI	2			
POFE6	2			
PORI2	1			
LARGE	1			
POIL	1			
VAAM3	1			

Various leaved milfoil

Individual Plant Bed Survey



Comments:

Rings Lake except for bays

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species susp
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 2 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: S 2

Bed Size: ~ 160 ac

Substrate: 2

Marl? 0

High Organic? 1

Waterbody Name: George

Waterbody ID:

Total # of Species 9

CanopyAbundance at Site

S: 4 N: – F: 1 E: –

SITE COORDINATES

Center of the Bed

Latitude: N41 45.621

Longitude: W85 0.627

Max. Lakeward Extent of Bed

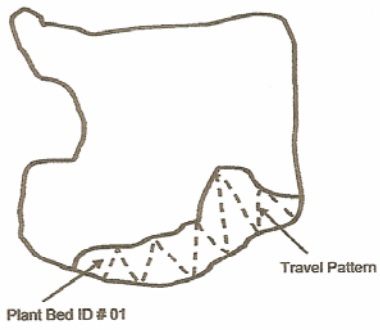
Latitude: N41 45.524

Longitude: W85 0.499

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
MYRI	2			
MYSP2	2			
MYST	2			
POZO	1			
LARGF	1			
POFE6	2			
POFO3	1			
PORI2	1			
UTMA	2			

Individual Plant Bed Survey



Comments: Bed # 2 → ~ 7-15ft deep

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species susp
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 3 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: S 3

Bed Size: Tall 5

Substrate: 3

Marl? 0

High Organic? 0

Waterbody Name: George

Waterbody ID:

Total # of Species 2

Canopy Abundance at Site

S: 4 N: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 45.421

Longitude: W85 0.947

Max. Lakeward Extent of Bed

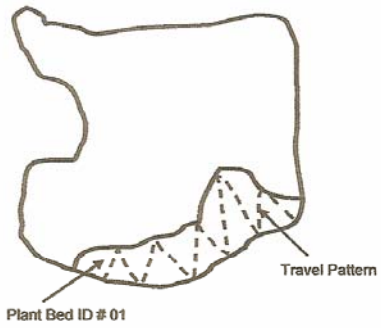
Latitude: N41 45.447

Longitude: W85 0.928

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	3			
PORT2	1			

Individual Plant Bed Survey



Comments:

More chara than bed # 1

Less SAV

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 4 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: S 4

Waterbody Name: George

Bed Size: ~9 ac

Substrate: 2

Waterbody ID:

Marl? 0

Total # of Species 9

High Organic? 1

Canopy Abundance at Site

S: 4 N: — F: 1 E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 45.874

Longitude: W85 0.178

Max. Lakeward Extent of Bed

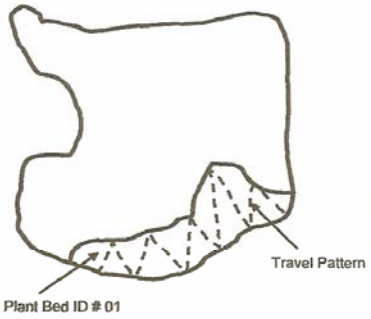
Latitude: N41 45.830

Longitude: W85 0.192

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	1			
MYSP2	3			
LARGE	1			
CHAR	1			
POZO	1			
POPE6	1			
MYRI	3			
MYSI	2			
ELCA7	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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4 = > 60%

Abundance:
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3 = Unknown

Voucher:
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1 = Taken, not varified
2 = Taken, varifier

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 5 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: S 5

Bed Size: 5½ Ac

Substrate: 2

Marl? 0

High Organic? 1

Waterbody Name: George

Waterbody ID:

Total # of Species 4

Canopy Abundance at Site: S: 4 N: 1 F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: N41 45.993

Longitude: W85 0.271

Max. Lakeward Extent of Bed

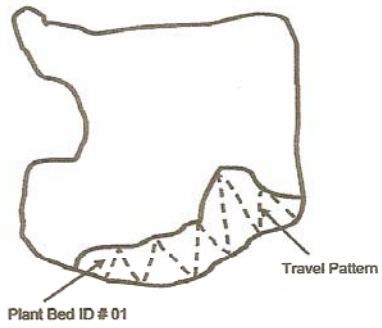
Latitude: N41 45.813

Longitude: W85 0.252

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POCR3	4			
MYSP2	2			
MY?RI	1			
IEXN	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
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1 = Species susp
2 = Genus suspected
3 = Unknown

Voucher:
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2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 6 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: 5 6

Waterbody Name: George

Bed Size: 23 ac

Substrate: 3

Waterbody ID:

Marl? 1

Total # of Species 5

High Organic? 0

CanopyAbundance at Site

S: 4 N: – F: – E: –

SITE COORDINATES

Center of the Bed

Latitude: N41 45.790

Longitude: W85 0.601

Max. Lakeward Extent of Bed

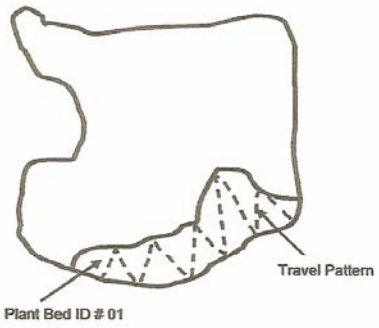
Latitude: N41 45.774

Longitude: W85 0.612

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHTAR	3			
MYRI	2			
LARGE	1			
PORTZ	1			
POPEG	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
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4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
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High Organic
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S = Submersed

Canopy:
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Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 7 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George Cottagers Association

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: 57

Bed Size: 14 acres

Substrate: 3

Marl? 1

High Organic? 0

Waterbody Name: George

Waterbody ID:

Total # of Species 11

Canopy Abundance at Site

S: 4 N: — F: — E: —

SITE COORDINATES

Center of the Bed

Latitude: N41 46.005

Longitude: W85 0.933

Max. Lakeward Extent of Bed

Latitude: N41 45.919

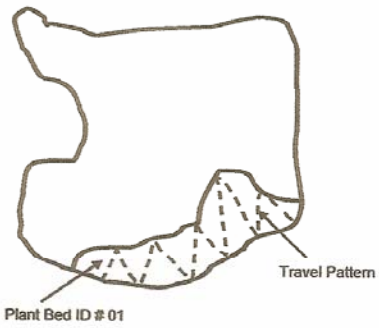
Longitude: W85 0.907

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
MYPRI	3			
MYSP2	3			
MYSI	1			
CHAR	2			
POZO	1			
LARGE	1			
POPE6	1			
POCR3	1			
ELCA7	1			
PORI2	1			
POFO3	1			

Various leaved milfoil

Individual Plant Bed Survey



Comments:

Northwest Corner by Boat Landing

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
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Canopy:
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Abundance:
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2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Emergent

Aquatic Vegetation Plant Bed Data Sheet

Page 8 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: E1

Waterbody Name: George

Bed Size: ½ acre

Substrate: 2

Waterbody ID:

Marl? 1

Total # of Species 3

High Organic? 1

Canopy Abundance at Site: S: – N: – F: – E: 4

SITE COORDINATES

Center of the Bed

Latitude: N41 46.022

Longitude: W85 1.056

Max. Lakeward Extent of Bed

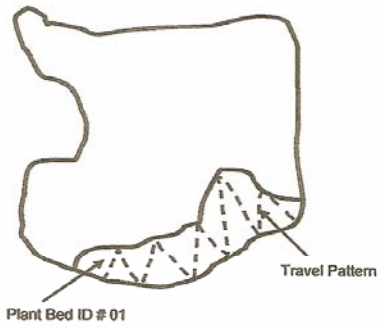
Latitude: N41 46.013

Longitude: W85 1.042

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	2			
Spatterdock	3			
Pickerelweed	2			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
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5 = Gravel/Rock
6 = Sand

Marl
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High Organic
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Overall Surface Cover
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Abundance:
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Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 9 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: E2

Waterbody Name: George

Bed Size: 4.6 acres

Substrate: 1

Waterbody ID:

Marl? 0

Total # of Species 5

High Organic? 1

Canopy Abundance at Site: S: — N: — F: — E: 4

SITE COORDINATES

Center of the Bed

Latitude: N41 46.040

Longitude: W85 0.855

Max. Lakeward Extent of Bed

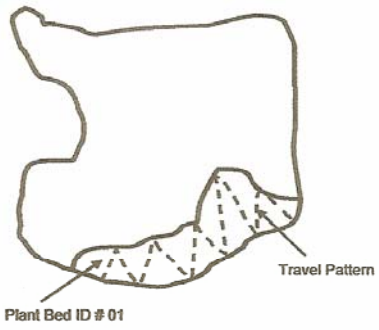
Latitude: N41 45.975

Longitude: W85 0.894

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
Cattail	3			
spatterdock	3			
softstembulrush	1			
Pickerelweed	1			
NPTV	2			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
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S = Submersed

Canopy:
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4 = > 60%

Abundance:
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Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page 10 of 10

State of Indiana Department of Natural Resources

ORGANIZATION: Lake George

DATE: 5/27/06

SITE INFORMATION

Plant Bed ID: E 3

Bed Size: ¼ acre

Substrate: 2

Marl? 0

High Organic? 1

Waterbody Name: George

Waterbody ID:

Total # of Species 5

CanopyAbundance at Site

S: — N: — F: — E: 4

SITE COORDINATES

Center of the Bed

Latitude: N41 45.868

Longitude: W85 0.076

Max. Lakeward Extent of Bed

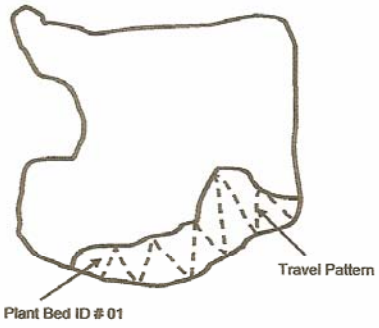
Latitude: N41 45.872

Longitude: W85 0.085 2

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTE	2			
Spatterdock	2			
Cattail	2			
Pickerelweed	1			
Cattail/Arrowhead	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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2 = 2-20%
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Abundance:
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Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

16.10 Permit Application

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004
☐ Whole Lake ☐ Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page 1 of
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
John Kindler	Lake George Association	
Rural Route or Street		Phone Number
325 Kope Kon Pointe		1-517-238-4828
City and State		ZIP Code
Coldwater MI		49036
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Jim Donahoe	Aquatic Weed Control	F-19215
Rural Route or Street		Phone Number
P. O. Box 325		1-574-533-2597
City and State		ZIP Code
Syracuse IN		46567

Lake (One application per lake)	Nearest Town	County
Lake George	Fremount	Steuben
Does water flow into a water supply		☐ Yes ☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment Area #	1	LAT/LONG or UTM's	Entire Indiana Shoreline on Map	
Total acres to be controlled	62	Proposed shoreline treatment length (ft)		Perpendicular distance from shoreline (ft) 100
Maximum Depth of Treatment (ft)	5	Expected date(s) of treatment(s)	Late May early June	

Treatment method: ☒ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate, 2-4,D

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	80
Richardson Pondweed		20

Page ___ of ___

Treatment Area #	LAT/LONG or UTM's	
Total acres to be ntrolled	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)
imum Depth of Treatment (ft)	Expected date(s) of treatment(s)	

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Renovate herbicide

Plant survey method: ☒ Rake ☐ Visual ☐ Other (specify)

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community

INSTRUCTIONS: Applicant must sign the application and is the only signature required. If applicant is also a certified chemical applicator, sign the "certified applicator" signature box

Applicant Signature	Date
Certified Applicator's Signature	Date

FOR OFFICE ONLY

☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204


DeLORME
Street Atlas USA® 2004 Plus
Pleasant Lake
FLINT HAVEN DR
SHAWNEE DR
DEERFIELD DR
PLEASANT RIDGE
FLINT RD
CAROLINE DR
WHALEY RD
KOPE KON RD
BAYVIEW DR
SANDY BEACH RD
KOPE KON PT
NEKOMA BEACH RD
S ANGOLA RD
SILVER RD
Lake George
W 796 N
N SILVER RD
W 795 N
LANE 130A LANE GEORGE
LANE 130B LAKE GEORGE
LANE 140C LAKE GEORGE
LANE 140E LAKE GEORGE
LANE 140A LAKE GEORGE
LANE 140B LAKE GEORGE
LANE 130C LAKE GEORGE
N OLD 27
SR 127
I-69
N VAN GUILDER RD
N BAKER RD
Jamestown
N JAMESTOWN RD
W 744 N
W 742 N
N 150 W
Crooked Creek
LANE 101 LONG BEACH LK
LANE 101A LONG BEACH LK
LANE 101B LONG BEACH LK
W 700 N
GRAVEL PIT DR
LANE 789 SNOW LK
LANE 825 SNOW LK
LANE 800 SNOW LK
N 575 W
781 N
W 660 N
I-80
120
144
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MN (5.4° W)
0 600 1200 1800 2400 3000 3600 ft
Data Zoom 13-2